California Water Plan - Update 2004

June 7, 2004

ADVISORY COMMITTEE REVIEW DRAFT

Volume 3: Regional Reports

Statewide Water Planning Branch
Department of Water Resources

June 7, 2004

WORKING DRAFT of REPORT

The California Department of Water Resources has posted for review and comment an ADVISORY COMMITTEE REVIEW DRAFT of Volumes 1, 2, 3 and 4 of the California Water Plan – Update 2004. These files are also available electronically at web site address:

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The deadline for receiving comments on this AC Review Draft is:

For Volume 1 - June 24, 2004
For Volumes 2, 3 & 4 - July 2, 2004

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Volume 3 - Regional Reports

Chapter 1. State Summary

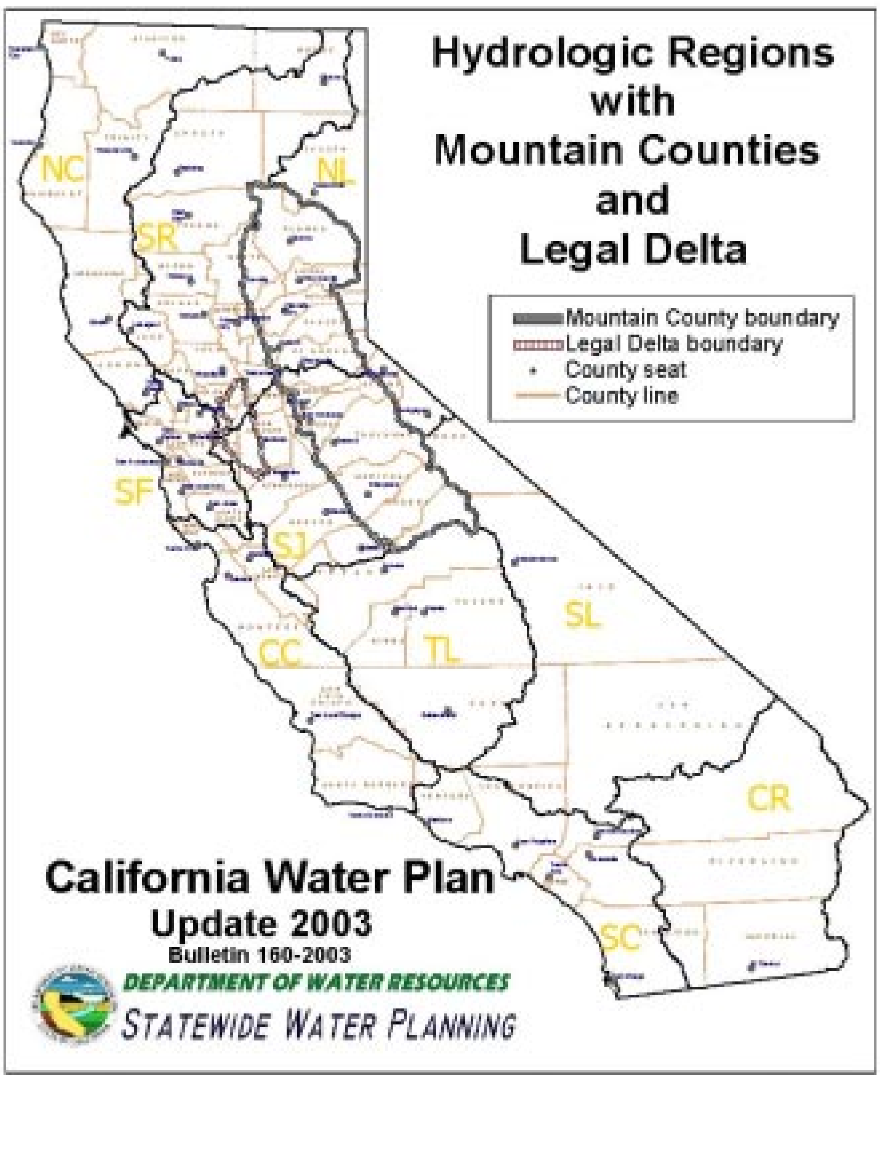
This volume contains a statewide summary of water supply and water use information for years 1998, 2000 and 2001, followed by twelve individual regional reports. Ten reports summarize California's hydrologic regions as shown in Figure 1. Two additional reports are included for the Mountain Counties Region and the Sacramento – San Joaquin Delta Region, to describe areas of special interest that overlay portions of two or more hydrologic regions.

Hydrologic Regions

California is a state of diverse climates and landforms. To better understand these diversities and plan for future needs, the Department subdivides California into ten hydrologic regions, corresponding to the state's major drainage basins (see Map A, below). These hydrologic regions provide a logical method for tracking and accounting for natural water runoff and how these water supplies are utilized.

For planning and data collection purposes, DWR subdivides the ten hydrologic regions into 56 planning areas (PA) plus a more detailed breakdown into 278 detailed analysis units (DAU). Most of DWR's data collection and analyses begin at the DAU level. The CWP Update aggregates results into hydrologic regions for presentation.

Map A



California's Ten Hydrologic Regions

North Coast. Klamath River and Lost River Basins, and all basins draining into the Pacific Ocean from the Oregon stateline southerly through the Russian River Basin.

San Francisco Bay. Basins draining into San Francisco, San Pablo, and Suisun Bays, and into Sacramento River downstream from Collinsville; western Contra Costa County; and basins directly tributary to the Pacific Ocean below the Russian River watershed to the southern boundary of the Pescadero Creek Basin.

Central Coast. Basins draining into the Pacific Ocean below the Pescadero Creek watershed to the southeastern boundary of Rincon Creek Basin in western Ventura County.

South Coast. Basins draining into the Pacific Ocean from the southeastern boundary of Rincon Creek Basin to the Mexican boundary.

Sacramento River. Basins draining into the Sacramento River system in the Central Valley (including the Pit River drainage), from the Oregon border south through the American River drainage basin.

San Joaquin River. Basins draining into the San Joaquin River system, from the Cosumnes River basin on the north through the southern boundary of the San Joaquin River watershed.

Tulare Lake. The closed drainage basin at the south end of the San Joaquin Valley, south of the San Joaquin River watershed, encompassing basins draining to Kern Lakebed, Tulare Lakebed, and Buena Vista Lakebed.

North Lahontan. Basins east of the Sierra Nevada crest, and west of the Nevada stateline, from the Oregon border south to the southern boundary of the Walker River watershed.

South Lahontan. The closed drainage basins east of the Sierra Nevada crest, south of the Walker River watershed, northeast of the Transverse Ranges, north of the Colorado River Region. The main basins are the Owens and the Mojave River Basins.

Colorado River. Basins south and east of the South Coast and South Lahontan regions; areas that drain into the Colorado River, the Salton Sea, and other closed basins north of the Mexican border.

Overlay Areas

Areas with common water issues or interests often cross the boundaries from one hydrologic region to another (see Chapter 4 of Volume 1 on regional planning). This is the first Water Plan Update in the Bulletin 160 series to begin to describe regions in a context beyond hydrologic regions. The two regional overlays that are described in this report are the Mountain Counties Region and the Sacramento – San Joaquin Delta Region, as shown in Map B, Mountain Counties and Legal Delta Overlays. There are many other regional overlays that could be developed, based on jurisdictional boundaries such as county lines or regional water agency boundaries. Two other examples are the California Bay Delta Authority's southern California regional area of influence, and the nine county regional boundary for the Association of Bay Area Governments.

Map B

Two Overlay Areas

Mountain Counties. The Mountain Counties include the foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range. The area includes the eastern portions of the Sacramento River and San Joaquin River hydrologic regions. This area shares common water and other resource issues and is the origin for much of the state's developed surface water supply.

Delta. The Legal Delta includes about 740,000 acres of tidally influenced land near the confluence of the Sacramento and San Joaquin Rivers. While the Delta occupies portions of the Sacramento, San Joaquin and a small part of the San Francisco hydrologic regions, the Delta is described as an overlay area because of its common characteristics, environmental significance, and its important role in the State's water systems.

Hydrology For Current Conditions

Previous bulletins included current year water use and supply data based upon a "normalized" year. Bulletin 160-98 developed average water year conditions based on actual water uses and supplies from year 1995 (which was actually a wet hydrologic year), which was then "normalized" - adjusted based on historic trends so that the 1995 level of water use would be representative of what would be expected to occur in a statistically average water supply year. In the same way, a drought scenario was calculated to represent anticipated 1995 level water uses under drought conditions.

As a result of the greater involvement of the Advisory Committee in the California Water Plan Update 2003, the previous process was changed. The Advisory Committee and the public requested that data be prepared and presented from actual years, without any statistical adjustments. Three recent years were selected to show the range of actual water supplies and uses, based on a range of hydrologic conditions:

- 1998, which was a wet water supply year statewide
- 2000, an overall average or normal water year
- 2001, a below average or dry year.

As a result of this new methodology the actual data presented in this report is not directly comparable to the normalized data presented in previous Bulletin 160 updates. The three recent years reflect the supplies and uses at a particular point in time and under specific conditions. Similarly the data for year 2001 does not constitute a drought scenario, but only presents conditions for one single below normal or dry year.

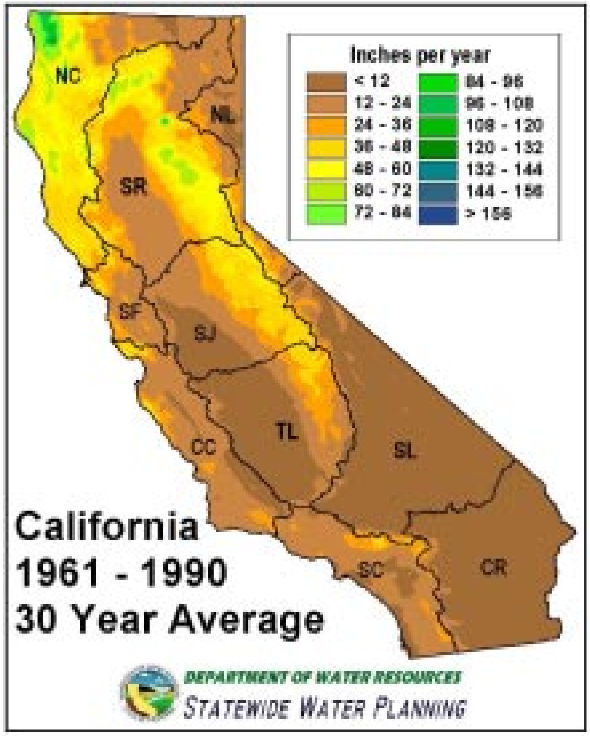
In addition, these generally wet, average, and dry conditions for the entire state are not universally the same for all regions of the state. Map C shows the long-term (based on years 1961 – 1990) mean annual precipitation for the state. For comparison, Maps D, E and F show the range of actual precipitation across the different regions of the state for years 1998, 2000, and 2001 respectively.

Water Portfolios

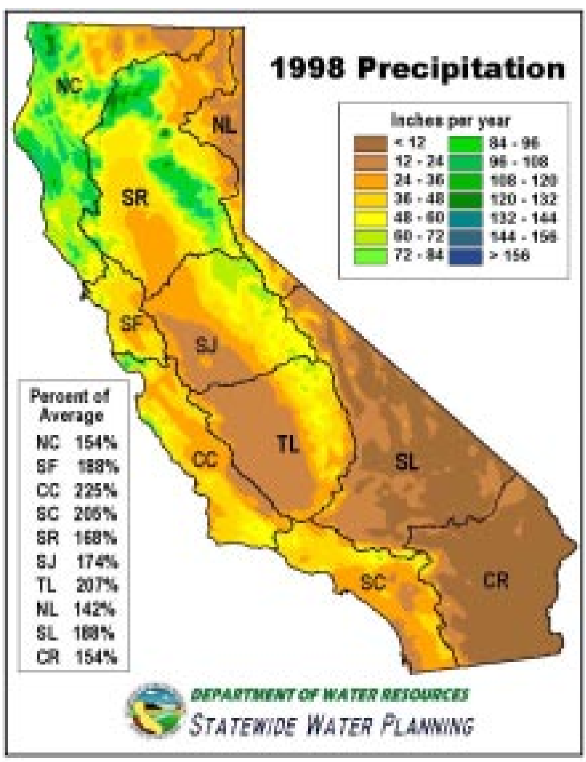
Traditionally, the updates to the *California Water Plan* have quantified current conditions and future forecasts through developed "water balances". For current conditions the previous balances compared information about the developed water supplies and uses, including the statistical adjustment of actual data to average or "normalized" conditions. The new water portfolio rationale proposed for this *California Water Plan Update* is intended to: (1) consider the "entire water pie" (all water supply sources), (2) provide better appreciation of the disposition of our source waters statewide by including additional categories of water supply and use, (3) present water balances using accepted accounting principles, (4) provide insight where there may be underutilized "assets" (supply) and unmet "liabilities" (uses), (5) provide insight in natural, physical (infrastructure), and institutional constraints, and water management decisions, by annotating water balances with narrative, and (6) include key supplemental information, for instance, on water quality, water rights, and water contracts. This concept is based on a traditional financial accounting portfolio, and is intended to identify all of the states water assets whether or not they are currently developed and used.

This volume presents a water portfolio for the entire state and for each of the state's 10 hydrologic regions and Mountain Counties, intended to identify all of the water supply sources and uses for each of the three specified years. For each region, the water portfolio information for each year is presented in two formats, a portfolio flow diagram (see Figures 1-2, 1-3 and 1-4), and as tabular information (see tables 1-2a, 1-2b and 1-2c). The portfolios are based on the concept of the hydrologic cycle, and identify all possible categories of statewide water supplies and uses. On a statewide and regional basis, the portfolio diagrams also show the routing of water from initial source of supply to final disposition. The basic data and assumptions that are presented in these portfolio diagrams have been assembled for smaller local and regional areas, and the accumulated to compile total portfolio amounts for the hydrologic regions and statewide. All of the information presented in the portfolio diagrams is also cross-referenced by number codes to tabular versions of this information. For consistency in each of the subsequent regional reports within Volume 3, the same portfolio format and data tables are also utilized.

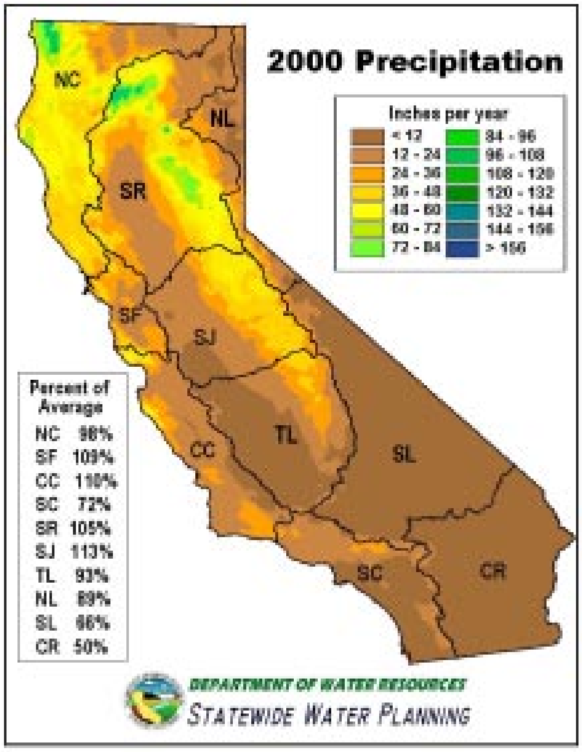
Map C


Inches per year
< 12
12 - 24
24 - 36
36 - 48
48 - 60
60 - 72
72 - 84
84 - 96
96 - 108
108 - 120
120 - 132
132 - 144
144 - 156
> 156
NC
NL
SR
SF
SJ
TL
CC
SL
SC
CR
California
1961 - 1990
30 Year Average
DEPARTMENT OF WATER RESOURCES
STATEWIDE WATER PLANNING

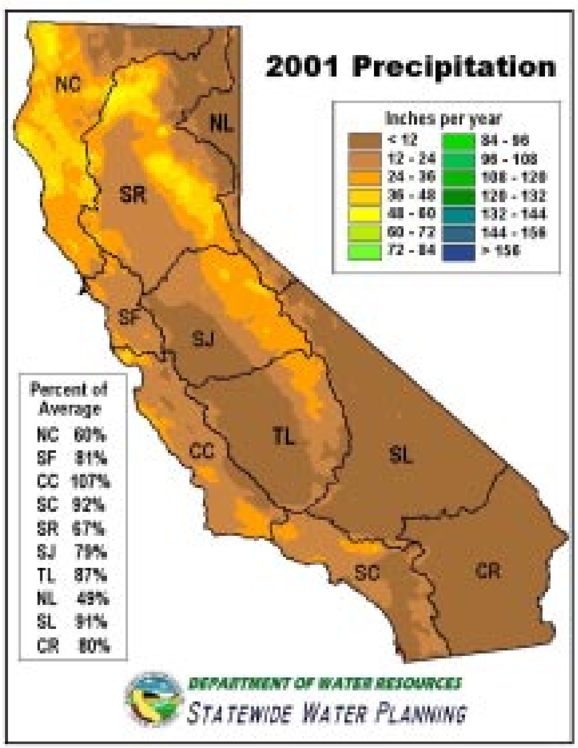
Map D


1998 Precipitation
Inches per year
< 12
12 - 24
24 - 36
36 - 48
48 - 60
60 - 72
72 - 84
84 - 96
96 - 108
108 - 120
120 - 132
132 - 144
144 - 156
> 156
NC
NL
SR
SF
SJ
TL
CC
SL
SC
CR
Percent of Average
NC 154%
SF 188%
CC 225%
SC 206%
SR 168%
SJ 174%
TL 207%
NL 142%
SL 188%
CR 154%
DEPARTMENT OF WATER RESOURCES
STATEWIDE WATER PLANNING

Map E


2000 Precipitation
Inches per year
< 12
12 - 24
24 - 36
36 - 48
48 - 60
60 - 72
72 - 84
84 - 96
96 - 108
108 - 120
120 - 132
132 - 144
144 - 156
> 156
NC
NL
SR
SF
SJ
CC
TL
SL
SC
CR
Percent of Average
NC 98%
SF 109%
CC 110%
SC 72%
SR 105%
SJ 113%
TL 93%
NL 89%
SL 66%
CR 50%
DEPARTMENT OF WATER RESOURCES
STATEWIDE WATER PLANNING

Map F


2001 Precipitation
Inches per year
< 12
12 - 24
24 - 36
36 - 48
48 - 60
60 - 72
72 - 84
84 - 96
96 - 108
108 - 120
120 - 132
132 - 144
144 - 156
> 156
NC
NL
SR
SF
SJ
CC
TL
SL
SC
CR
Percent of Average
NC 60%
SF 81%
CC 107%
SC 92%
SR 67%
SJ 79%
TL 87%
NL 49%
SL 91%
CR 80%
DEPARTMENT OF WATER RESOURCES
STATEWIDE WATER PLANNING

The key principle of these new water portfolio tables and flow diagrams is that they attempt to provide an accounting of all water that enters and leaves the state, and water that is exchanged between regions, which is an important tool for all water planning activities. One shortcoming of this expanded process is that there are many regions of the state where some of the water portfolio data categories have never been measured or quantified. Thus, the resulting water portfolios also show many categories where inadequate data are available. However, the ability to identify where additional data collection activities are needed is an important byproduct of this process. Another disadvantage with using real data from three specific years is that those years provide no information about how supplies and demands would change during a sequence of dry years. Future development of a series of ten or more actual years of data would be very helpful for developing representative conditions for both average and sustained drought conditions.

Water Portfolio Components

The water portfolios for the California Water Plan Update consists of the following items:

Flow Diagrams
The flow diagrams presented in Update 2003 are an expanded version of the diagram that originally appeared in Bulletin 160-83 on page 88. The flow diagram begins with the sources of water, such as precipitation and inflows into the state, and attempts to track all the water as it flows through many different uses until it reaches its ultimate destination in the ocean, inland sea or the atmosphere. Diagrams have been prepared for each of the 10 hydrologic regions, Mountain Counties, and statewide totals.

Flow Diagram Table Format

The Flow Diagram Table provides additional detail, by presenting each of the components of the flow diagram by number and category (inputs or withdrawals).

Water Balances
As in Bulletin 160-98, water balances are computed for applied water use, net water use and depletion for each region and planning area within a region, Mountain Counties and the state. The balances include measured water supplies that are applied to the following uses within a region:

- Agricultural
- Urban (including commercial and industrial)
- Wildlife refuge
- Instream requirement
- Wild and scenic river requirement
- Required delta outflow

It includes reuse of water within a region, but not water exported from a region.

Water Quality
The water quality basin plans prepared by the SWRCB and RWQCB will eventually become part of the California Water Plan. The basin plans along with other water quality reports will be integrated regionally into the water portfolio.

Applied Water Methodology

As previously developed in Bulletin 160-98, this CWP Update computes water supplies and uses on the basis of applied water data. Applied water refers to the total amount of water from any source that is diverted to meet the demands of water users. Within Volume 3, all of the tables that show statewide totals present information on an “applied water” basis. However, for each of the individual regional reports, the information has been expanded to include applied water uses,net water uses, and depletion. Net water supply and net water use values are smaller than applied water use because they do not count that portion of any water demand that is met by reapplication of either surface or groundwater supplies. Water supply information that is presented using applied water methodology is easier for local water agencies to evaluate, because applied water use information is similar in concept to agency water system delivery data.

Key Water Supply and Water Use Definitions

The water portfolio tables presented throughout Volume 3 summarize California's water supplies and urban, agricultural and environmental water uses for years 1998, 2000 and 2001. Certain key concepts, defined below, provide an essential foundation for understanding and evaluating the water supplies and water uses presented in these tables.

Applied Water : The amount of water from any source needed to meet the demand of the user. Examples would include the quantity of water that is delivered at any of the following locations:

- The intake to a city water system or a factory.
- The farm headgate or other point of measurement for agricultural use.
- The diversion point to a managed wetland, either directly or from other drainage flows.

For instream use, applied water is quantified as the amount of stream flow dedicated to instream purposes (or reserved under federal or State wild and scenic rivers legislation). It is also identified as the amount of stream flow required for maintaining flow and water quality in the Sacramento - San Joaquin Delta per the SWRCB's Decision 1630 or previous standards.

Net Water: The amount of water needed in a water service area to meet all demands. It is the sum of several components including (1) evapotranspiration of applied water within an area, (2) the irrecoverable losses from the distribution system, and (3) the agricultural return flow or treated urban wastewater leaving the area.

Irrecoverable Losses: The amount of water lost to a salt sink, lost by evapotranspiration, or lost by evaporation from a conveyance facility or drainage canal.

Evapotranspiration: ET is the amount of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and the surrounding soil surfaces.

Evapotranspiration of Applied Water: ETAW is the portion of total ET which was provided from the applied irrigation water.

Depletion: The amount of water consumed within a service area that is no longer available as a source of supply. For agricultural and environmental wetlands water use, depletion is the sum of irrecoverable losses and the ETAW due to crops, wetlands vegetation, and flooded water surfaces. For urban water use, depletion is the ETAW due to landscaping, wastewater outflow to a salt sink, and incidental ET losses. For environmental instream use, depletion is the amount of dedicated flow that proceeds to a salt sink.

Statewide Water Balance Summary

In average water years like 2000, California receives close to 200 million acre-feet of water from precipitation and imports from Colorado, Oregon and Mexico. Of this total supply, about 50-60 percent either is used by native vegetation, evaporates to the atmosphere, provides some of the water for agricultural crops and managed wetlands (effective precipitation); or flows to Oregon, Nevada, the Pacific Ocean, and salt sinks like saline groundwater aquifers and the Salton Sea. The remaining 40-50 percent, or dedicated supply, is distributed among urban and agricultural uses, water for protecting and restoring the environment, or storage in surface and groundwater reservoirs for later use. In any year, some of the dedicated supply includes water that is used multiple times (reuse) and water stored from previous years. Ultimately, about a third of the dedicated supply flows out to the Pacific Ocean, in part to meet environmental requirements, or to other salt sinks.

The information presented in the table below summarizes the total supply and the distribution of the dedicated supply to various uses within California for the three years evaluated. As indicated for wet (1998) and dry (2000) years, the total supply and the distribution of the dedicated supply to various uses changes significantly from the average year 2000 values.

California Water Balance Summary For Water Years 1998, 2000 and 2001

	1998 (Wet Year)	**2000 (Avg Year)**	**2001 (Dry Year)**
Total Supply (Precipitation & Imports)	335.8 maf	194.2 maf	145.5 maf
Dedicated Supply (Includes Reuse)	97.4 maf	82.5 maf	64.9 maf
Distribution of Dedicated Supply to Various Applied Water Uses			
Urban Uses	7.7 maf (8%)	8.8 maf (11%)	8.6 maf (13%)
Agricultural Uses	27.6 maf (28%)	34.3 maf (42%)	33.9 maf (52%)
Environmental Water *	62.1 maf (64%)	39.4 maf (47%)	22.4 maf (35%)

* Environmental water includes instream flows, wild & scenic flows, required Delta Outflow and managed wetlands water use.

Table 1-1 provides more detailed information about total statewide water supply sources and provides estimates for the primary uses of the State's supplies. As indicated, a large component of the statewide water supply is used by natural processes (evaporation, evapotranspiration from native vegetation and forests, percolation to groundwater, etc) and is often not part of the developed water supplies. In the following chapters of Volume 3, each of the regional reports presents the same tabular information at the regional level of analysis. For some of the items presented in Table 1-1, the numerical values were developed by estimation techniques, because measured data is not available on a statewide basis.

A statewide summary of Dedicated Water Supplies and Uses is presented in Table 1-3, which provides a more detailed breakdown of the components of developed supplies that are used for agricultural, urban and environmental purposes. For each of the three water years shown, information is presented as both applied and net water usage, as well as the calculated total water depletion. As previously mentioned, much of the environmental water usage in this table is actually dedicated to instream flow requirements and wild & scenic rivers, which in some cases can later be reused for other downstream purposes.

Statewide Water Portfolio Results For Years 1998 (Wet), 2000 (Average) and 2001 (Dry)

Statewide summaries of water supplies and applied water uses are presented graphically in the portfolio flow diagrams (Figures 1-2, 1-3 and 1-4), and numerically in the water portfolio data tables Tables 1-2a, 1-2b and 1-2c). The primary purpose of these diagrams and tables is to present information for comparison about how water supplies and use can vary between the wet, average, and dry hydrologic conditions that are represented by these three specific years. It is important to remember that actual water supply and water use information from each of these three specific years is only a snapshot of a single year's hydrology and water uses. It would not be appropriate to assume that other past or future years with similar hydrology (wet, average, or dry) would generate the exact same level of water uses as summarized for these three years.

The statewide information has been assembled from the ten individual hydrologic regions that are presented in the following chapters. The organizational structure of the portfolio diagrams and the numerical identification for the data categories is consistently maintained between the ten regional reports and these statewide summaries. However, note that when water supply and water use information from the regional reports is accumulated for the statewide totals, some categories (such as inter-regional water transfers between one hydrologic region and an adjoining region) are not relevant, and are thus not shown in the statewide tables. Within the statewide diagrams and tables presented in this Chapter there are several categories that indicate "incomplete" or "unknown" data, for components of water supply and water use where information is either not available, or only partially available from some regions of the state. Within the data tables, the code "N/A" is used to identify categories where data is not available, and the symbol "-" has been used to identify water data categories that are "not applicable" on a statewide basis.

On a statewide basis the Water Portfolio Flow Diagrams in Figures 1-2, 1-3 and 1-4 show detailed flow diagrams for water supplies and uses for years 1998, 2000, and 2001 respectively. In both the statewide and regional portfolio diagrams, the information is organized to show sources of water supply on the left side, water uses in the middle, and the final disposition of the ways that water leaves the state is depicted on the right side. To assist the reader in following the movement of water from initial sources to final disposition, water supplies (called "deposits") are consistently shown in blue boxes, water uses are summarized in green boxes, and water withdrawals (how water leaves the state) are shown in yellow boxes. The numerical identification numbers in the small circles all correspond the tabular presentation of the data in Tables 1-2a, 1-2b and 1-2c.

The Flow Diagram Data Tables show the information presented in the flow diagrams in tabular form, with sixty major categories of water supply and use identified. These statewide tables are different from the regional data tables presented in the following chapters, in that there is only one column shown for each hydrologic region in which water supply and "applied" water use information has been aggregated. The regional tables in the following chapters also present water use information on a "net water" basis and tabulate water depletions where appropriate. In addition, there are several water data categories that are accounted for at the regional level, but which lose there relevance at the statewide level (such as inter-regional water transfers). In these cases the "- not applicable" symbol is shown in many boxes on the statewide table, but actual data will be presented within the regional tables in the following chapters.

Statewide Water Data Needs

When the concept of developing water portfolios with information about all of California's supplies and uses was first discussed, it was noted that there would be insufficient information available for many of the data categories and several of the less developed regions of the State. However, identifying the categories where inadequate information is available is a necessary first step towards improving water data collection needs.

The types of needed technical information can be grouped into three categories which are described as:

- Data – factual (or observed) information, such as measurements or statistics (e.g., gauged flows in a river, population as measured by census, and salinity of a water sample). Sets of data can be raw (as taken from measurement device) or elaborated (modified slightly as part of quality assessment and quality control measures, or supplemented to address missing measurements).
- Relationships (or system interactions) – descriptions of how the social, physical, and environmental systems affect or are affected by the status of water supply and water use in California (e.g., how releases from a reservoir affect water temperature at a point in a river downstream, the crop mix in a region and the expected market conditions for each crop, and snow pack conditions in February and the delivery of SWP water).
- Estimates – inferred, derived and/or forecasted quantities based on available data, defined relationships, and other assumptions (e.g., population forecasts for the Los Angeles area in 2030, groundwater flows between sub basins, future available water deliveries, and the cost to implement water conservation best management practices).

There are a number of categories where data are simply not available or very resource intensive to compile. See the reference guide for a complete description of data gaps. Significant data gaps include:

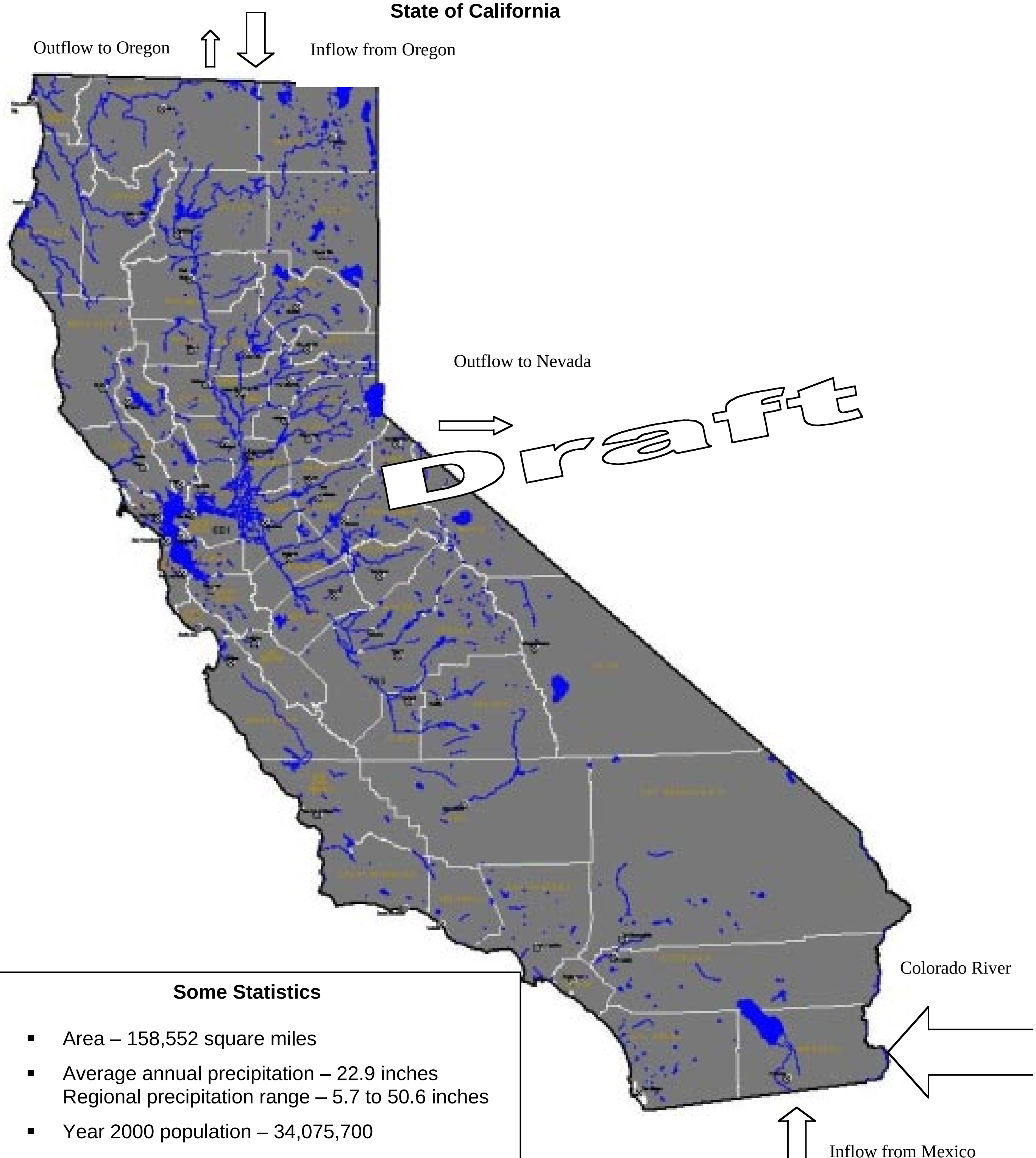
- statewide land use data (e.g., native vegetation, urban footprints, non-irrigated agriculture, and irrigated agriculture)
- groundwater (total natural recharge, subsurface inflow and outflow, recharge and extractions, levels, and water quality)
- surface water (natural and incidental runoff, local diversions, return flows, total stream flows, conveyance losses, and runoff to salt sinks)
- losses (evaporation and evapotranspiration from native vegetation, wetlands, urban runoff and unirrigated agricultural production)

There are a number of data items necessary to calculate or estimate these categories. Some of the major data items needed to complete the flow diagram and water balances consist of more detailed and accessible land and water use information including information to separate out applied water use versus consumptive water use. The major data items are:

- water source of supply information,
- outflow data,
- groundwater level data,
- groundwater recharge rates,
- natural riparian water requirements,
- evapotranspiration rates for all types of vegetation,
- detailed return flow information and
- more detailed physical information about all watersheds, water systems and groundwater basins in the state.

A significant increase in the amount of data collected and evaluated will be necessary, before California can fully understand the State's water supplies and plan for future water needs.

Figure1-1
State of California



Some Statistics

- Area – 158,552 square miles
- Average annual precipitation – 22.9 inches
  Regional precipitation range – 5.7 to 50.6 inches
- Year 2000 population – 34,075,700
- 2030 projected population –
- Total reservoir storage capacity – 40,741 TAF
- 2000 irrigated agriculture - 8,975,110 acres

Table 1-1
California Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

(See flow diagrams and tables for details)	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the State			
Precipitation	329.6	187.7	139.2
Inflow from Oregon/Mexico	1.2	1.2	1.2
Inflow from Colorado River	5.0	5.3	5.1
Imports from Other Regions	N/A	N/A	N/A
Total	**335.8**	**194.2**	**145.5**
Water Leaving the State			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	19.9	25.2	25.2
Outflow to Oregon/Nevada/Mexico	1.5	0.9	0.7
Exports to Other Regions	N/A	N/A	N/A
Statutory Required Outflow to Salt Sink	48.6	30.6	16.2
Additional Outflow to Salt Sink	40.2	18.2	9.7
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	220.3	125.2	108.1
Total	**330.5**	**200.1**	**159.9**
Storage Changes in State [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	7.1	-1.4	-4.6
Change in Groundwater Storage **	-1.8	-4.5	-9.8
Total	**5.3**	**-5.9**	**-14.4**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	34.1	41.8	41.4

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 1-2a
California Statewide Water Portfolios for Water Year 1998

The flow diagram is regional data only.

Inputs:	In Thousand Acre-feet	NC 1998	SF 1998	CC 1998	SC 1998	SR 1998	SJ 1998	TL 1998	NL 1998	SL 1998	CR 1998	CA 1998	MC 1998
1	Colorado River Deliveries	-	-	-	1,081.3	-	-	-	-	-	3,904.9	4,986.2	-
2	Total Desalination	-	-	-	-	-	-	-	-	-	-	0.0	-
3	Water from Refineries	-	-	-	-	-	-	-	-	-	-	0.0	-
4a	Inflow From Oregon	1,322.5	-	-	-	-	-	-	-	-	-	1,322.5	-
b	Inflow From Mexico	-	-	-	-	-	-	-	-	-	182.4	182.4	-
5	Precipitation	79,216.3	11,438.0	25,201.6	20,873.0	89,500.1	35,534.7	27,305.9	10,654.6	20,409.3	9,454.8	329,588.3	55,205.7
6a	Runoff - Natural	53,812.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	53,812.0	N/A
b	Runoff - Incidental	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
7	Total Groundwater Natural Recharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
8	Groundwater Subsurface Inflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
9	Local Deliveries	375.4	273.4	73.1	292.1	14,297.8	3,264.7	3,623.3	501.4	56.6	6.6	22,764.4	1,954.0
10	Local Imports	2.0	500.3	-	401.9	9.7	-	-	0.3	-	-	914.2	9.7
11a	Central Valley Project :: Base Deliveries	-	-	0.5	-	1,588.8	148.0	-	-	-	-	1,737.3	5.5
b	Central Valley Project :: Project Deliveries	-	120.6	17.6	-	418.6	1,248.7	1,820.1	-	-	-	3,625.6	20.2
12	Other Federal Deliveries	334.5	38.6	54.1	4.2	198.0	63.4	-	-	-	-	692.8	1.6
13	State Water Project Deliveries	-	148.5	24.6	690.2	14.9	4.3	1,223.0	-	73.2	156.4	2,335.1	-
14a	Water Transfers - Regional	-	1.0	-	-	-	-	-	-	-	-	1.0	-
b	Water Transfers - Imported	-	-	-	-	-	-	-	-	-	-	0.0	-
15a	Releases for Delta Outflow - CVP											0.0	
b	Releases for Delta Outflow - SWP											0.0	
c	Instream Flow	1,445.3	23.1	20.3	3.5	3,699.6	1,528.9	-	84.6	98.4	-	6,903.7	1,569.5
16	Environmental Water Account Releases	-	-	-	-	0.0	-	-	-	-	-	0.0	-
17a	Conveyance Return Flows to Developed Supply - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Return Flows to Developed Supply - Ag	-	-	-	-	60.1	-	-	-	-	-	60.1	23.0
c	Conveyance Return Flows to Developed Supply - Managed Wetlands	-	-	-	-	-	-	-	-	-	-	0.0	-
18a	Conveyance Seepage - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Seepage - Ag	5.3	-	-	-	206.0	6.6	-	5.8	-	-	223.7	3.6
c	Conveyance Seepage - Managed Wetlands	-	-	-	-	23.8	-	-	-	-	-	23.8	-
19a	Recycled Water - Agriculture	11.7	10.5	-	-	-	1.2	-	5.0	-	-	28.4	1.2
b	Recycled Water - Urban	0.3	5.7	17.5	211.6	-	0.7	-	-	28.0	16.0	279.8	-
c	Recycled Water - Groundwater	-	6.2	-	2.1	-	-	-	-	-	-	8.3	-
20a	Return Flow to Developed Supply - Ag	12.5	-	-	-	985.4	1,259.0	-	-	-	-	2,256.9	56.0
b	Return Flow to Developed Supply - Wetlands	-	-	-	-	4.0	132.6	3.1	-	-	-	139.7	-
c	Return Flow to Developed Supply - Urban	4.0	-	23.4	319.8	11.9	-	-	1.5	63.5	145.4	569.5	-
21a	Deep Percolation of Applied Water - Ag	52.6	-	212.1	92.8	179.1	157.7	1,347.8	19.8	42.8	78.5	2,183.2	6.0
b	Deep Percolation of Applied Water - Wetlands	1.2	-	-	-	8.3	174.3	27.3	0.3	-	-	211.4	-
c	Deep Percolation of Applied Water - Urban	14.6	43.4	53.0	-	79.8	204.1	348.1	12.7	-	-	755.7	19.2
22a	Reuse of Return Flows within Region - Ag	67.5	-	-	-	367.7	-	-	27.9	-	119.9	583.0	7.7
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S	143.5	-	165.4	287.7	1,001.4	5,190.0	3,205.0	313.5	18.6	-	10,325.1	4,917.6
24a	Return Flow for Delta Outflow - Ag	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S	-	-	-	-	5,897.3	0.1	-	-	-	-	5,897.4	3,403.8
c	Return Flow for Delta Outflow - Urban Wastewater	-	-	-	-	-	-	-	-	-	-	0.0	-
25	Direct Diversions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
26	Surface Water in Storage - Beg of Yr	2,236.3	491.3	589.1	1,380.6	9,727.2	6,943.0	865.3	853.2	329.4	580.8	23,996.2	11,595.4
27	Groundwater Extractions - Banked	-	-	-	-	-	-	-	-	-	-	0.0	-
28	Groundwater Extractions - Adjudicated	-	-	-	711.4	-	-	-	-	61.8	-	773.2	-
29	Groundwater Extractions - Unadjudicated	221.1	72.1	905.1	592.8	1,855.9	1,750.2	2,535.7	88.5	247.5	254.3	8,523.2	60.5
Withdrawals:	**In Thousand Acre-feet**												
23	Groundwater Subsurface Outflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	-
30	Surface Water Storage - End of Yr	2,938.8	567.6	990.1	1,752.5	12,479.2	9,122.9	1,303.6	1,000.0	401.5	566.3	31,122.5	14,015.1
31	Groundwater Recharge-Contract Banking	-	-	-	-	-	-	99.8	-	-	-14.7	85.1	-
32	Groundwater Recharge-Adjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
33	Groundwater Recharge-Unadjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
34a	Evaporation and Evapotranspiration from Native Vegetation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
b	Evaporation and Evapotranspiration from Unirrigated Ag	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
35a	Evaporation from Lakes	38.9	10.1	10.0	18.5	320.7	77.3	39.3	294.6	162.4	1,555.5	2,527.3	92.4
b	Evaporation from Reservoirs	167.5	104.4	74.2	149.1	700.7	419.9	232.9	175.5	45.1	120.0	2,189.3	630.2
36	Ag Effective Precipitation on Irrigated Lands	215.7	-	167.8	39.0	1,358.0	N/A	-	55.8	-	-	1,836.3	75.2
37	Agricultural Use	633.1	101.8	822.7	699.9	5,845.1	5,160.6	7,839.2	375.1	326.8	3,570.5	25,374.7	261.3
38	Wetlands Use	391.4	6.2	0.1	31.2	398.3	411.4	63.1	18.7	-	31.6	1,352.0	-
39a	Urban Residential Use - Single Family - Interior	42.4	132.2	55.5	976.8	115.2	88.0	101.6	3.5	66.9	84.4	1,666.5	29.4
b	Urban Residential Use - Single Family - Exterior	19.8	308.2	69.9	659.4	231.0	160.6	155.1	5.1	59.2	121.7	1,790.0	60.4
c	Urban Residential Use - Multi-family - Interior	10.9	183.0	33.1	591.5	72.3	92.7	106.9	4.4	11.0	20.3	1,126.1	10.2
d	Urban Residential Use - Multi-family - Exterior	2.7	45.7	17.3	104.6	18.1	43.8	64.3	1.1	7.2	14.3	319.1	3.3
40	Urban Commercial Use	20.8	212.4	48.4	694.8	112.7	38.7	37.5	9.0	26.0	48.0	1,248.3	10.8
41	Urban Industrial Use	26.8	53.1	26.0	182.8	77.4	34.1	53.4	12.5	8.2	3.3	477.6	10.3
42	Urban Large Landscape	4.8	80.6	12.0	166.6	91.5	33.7	16.0	2.3	7.7	161.2	576.4	11.3
43	Urban Energy Production	-	-	14.3	39.8	-	-	-	-	6.3	76.7	137.1	-
44	Instream Flow	1,445.3	23.1	20.3	3.5	3,699.6	1,528.9	-	84.6	98.4	-	6,903.7	1,569.5
45	Required Delta Outflow	-	-	-	-	9,505.0	-	-	-	-	-	9,505.0	-
46	Wild & Scenic Rivers Use	33,290.1	-	318.6	284.2	3,124.4	3,661.1	3,205.0	404.1	-	-	44,287.6	6,751.9
47a	Evapotranspiration of Applied Water - Ag	449.8	78.3	580.8	500.8	3,693.1	3,409.7	5,181.4	241.1	216.8	2,466.1	16,817.9	176.9
b	Evapotranspiration of Applied Water - Managed Wetlands	155.7	3.1	0.1	31.2	127.5	104.4	32.8	13.2	-	31.6	499.6	-
c	Evapotranspiration of Applied Water - Urban	22.1	303.0	91.6	930.6	315.2	187.6	187.0	8.8	74.1	297.2	2,417.2	59.3
48	Evaporation and Evapotranspiration from Urban Wastewater	2.5	-	-	-	0.2	-	-	-	-	-	2.7	-
49	Return Flows Evaporation and Evapotranspiration - Ag	29.6	-	3.2	11.6	122.2	74.4	-	19.5	6.7	90.7	357.9	6.0
50	Urban Waste Water Produced	87.9	582.8	43.0	1,798.9	252.2	76.4	-	24.6	28.5	59.8	2,954.1	43.4
51a	Conveyance Evaporation and Evapotranspiration - Urban	-	7.1	8.6	343.9	4.9	15.1	10.6	-	9.0	37.1	436.3	10.0
b	Conveyance Evaporation and Evapotranspiration - Ag	6.9	0.5	11.8	-	40.6	211.9	442.5	2.3	-	64.0	780.5	10.7
c	Conveyance Evaporation and Evapotranspiration - Managed Wetland	0.4	-	-	-	11.7	-	-	0.2	-	-	12.3	-
d	Conveyance Loss to Mexico	-	-	-	-	-	-	-	-	-	N/A	0.0	-
52a	Return Flows to Salt Sink - Ag	23.1	24.0	32.4	104.2	643.9	37.2	477.3	68.3	60.9	1,089.8	2,561.1	12.4
b	Return Flows to Salt Sink - Urban	85.0	675.9	98.0	1,972.5	313.5	109.2	-	14.9	56.8	183.2	3,509.0	67.2
c	Return Flows to Salt Sink - Wetlands	1.7	3.1	-	-	179.2	-	-	-	-	-	184.0	-
53	Remaining Natural Runoff - Flows to Salt Sink	34,715.0	23.1	173.5	-	33,981.9	-	-	180.2	79.8	-	69,153.5	0.0
54a	Outflow to Nevada	-	-	-	-	-	-	-	1,390.6	-	-	1,390.6	-
b	Outflow to Oregon	109.3	-	-	-	-	-	-	-	-	-	109.3	-
c	Outflow to Mexico	-	-	-	-	-	-	-	-	-	-	0.0	-
55	Regional Imports	2.0	308.7	107.9	2,575.3	668.5	5,191.8	3,824.3	0.3	543.2	5,142.6	18,364.6	0.0
56	Regional Exports	680.5	0.0	65.8	0.0	2,266.2	4,013.3	2,391.7	11.9	871.2	1,081.3	11,381.9	4,373.6
59	Groundwater Net Change in Storage	-46.9	-70.4	-639.1	-1,211.4	739.9	-443.1	432.2	10.0	-260.1	-57.6	-1,546.5	-12.5
60	Surface Water Net Change in Storage	702.5	76.3	401.0	371.9	2,752.0	2,179.9	438.3	146.8	72.1	-14.5	7,126.3	2,419.7
61	Surface Water Total Available Storage	3,779.9	746.1	1,226.8	2,112.7	16,145.6	11,372.3	2,046.1	1,181.2	458.9	620.4	39,690.0	18,185.0

N/A - Data Not Available   "-" - Data Not Applicable   "0" - Null value

Table 1-2b
California Statewide Water Portfolios for Water Year 2000

The flow diagram is regional data only.

Inputs:	In Thousand Acre-feet	NC 2000	SF 2000	CC 2000	SC 2000	SR 2000	SJ 2000	TL 2000	NL 2000	SL 2000	CR 2000	CA 2000	MC 2000
1	Colorado River Deliveries	-	-	-	1,296.0	-	-	-	-	-	4,052.8	5,348.8	-
2	Total Desalination	-	-	-	-	-	-	-	-	-	-	0.0	-
3	Water from Refineries	-	-	-	-	-	-	-	-	-	-	0.0	-
4a	Inflow From Oregon	1,396.7	-	-	-	-	-	-	-	-	-	1,396.7	-
b	Inflow From Mexico	-	-	-	-	-	-	-	-	-	165.6	165.6	-
5	Precipitation	50,755.1	6,643.7	12,596.4	7,522.1	57,105.9	23,208.5	12,692.9	6,708.3	7,476.1	3,033.9	187,742.9	38,412.
6a	Runoff - Natural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
b	Runoff - Incidental	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
7	Total Groundwater Natural Recharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
8	Groundwater Subsurface Inflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
9	Local Deliveries	592.4	241.9	50.4	211.4	12,189.0	3,455.4	2,275.6	469.5	58.1	6.3	19,550.0	1,516.
10	Local Imports	3.1	502.0	-	273.1	10.9	-	-	0.3	-	-	789.4	10.9
11a	Central Valley Project :: Base Deliveries	-	-	27.3	-	1,930.8	167.4	-	-	-	-	2,125.5	6.1
b	Central Valley Project :: Project Deliveries	-	118.1	23.9	-	554.2	1,667.0	2,272.3	-	-	-	4,635.5	20.2
12	Other Federal Deliveries	408.7	34.5	61.4	0.6	228.3	63.2	-	-	-	-	796.7	1.6
13	State Water Project Deliveries	-	155.6	30.9	1,298.9	14.9	4.7	1,955.5	-	108.0	100.6	3,669.1	-
14a	Water Transfers - Regional	-	1.0	-	-	-	-	-	-	-	-	1.0	-
b	Water Transfers - Imported	-	-	-	-	-	-	-	-	-	-	0.0	-
15a	Releases for Delta Outflow - CVP											0.0	
b	Releases for Delta Outflow - SWP											0.0	
c	Instream Flow	1,444.5	21.5	21.4	3.5	3,759.8	2,098.5	-	85.0	88.8	-	7,523.0	1,563.
16	Environmental Water Account Releases	-	-	-	-	264.0	-	-	-	-	-	264.0	-
17a	Conveyance Return Flows to Developed Supply - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Return Flows to Developed Supply - Ag	-	-	-	-	44.7	-	-	-	-	-	44.7	-
c	Conveyance Return Flows to Developed Supply - Managed Wetlands	-	-	-	-	-	-	-	-	-	-	0.0	-
18a	Conveyance Seepage - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Seepage - Ag	6.4	-	-	-	270.0	6.6	-	3.6	-	-	286.6	4.7
c	Conveyance Seepage - Managed Wetlands	-	-	-	-	24.5	-	-	-	-	-	24.5	-
19a	Recycled Water - Agriculture	11.7	10.3	-	-	-	1.2	-	5.0	-	-	28.2	1.2
b	Recycled Water - Urban	0.3	5.9	18.5	182.8	-	0.7	-	-	29.0	17.2	254.4	-
c	Recycled Water - Groundwater	-	6.2	-	37.1	-	-	-	-	-	-	43.3	-
20a	Return Flow to Developed Supply - Ag	6.9	-	-	-	1,215.1	677.1	-	-	-	-	1,899.1	-
b	Return Flow to Developed Supply - Wetlands	-	-	-	-	4.2	126.7	2.5	-	-	-	133.4	-
c	Return Flow to Developed Supply - Urban	3.6	-	26.4	386.7	11.8	-	-	2.0	81.5	161.0	673.0	-
21a	Deep Percolation of Applied Water - Ag	61.2	-	254.2	114.8	299.8	844.2	1,928.4	28.9	44.2	84.6	3,660.3	6.1
b	Deep Percolation of Applied Water - Wetlands	1.3	-	-	-	11.6	166.5	29.7	0.4	-	-	209.5	-
c	Deep Percolation of Applied Water - Urban	19.4	44.0	62.6	-	88.7	219.7	414.5	13.3	-	-	862.2	17.6
22a	Reuse of Return Flows within Region - Ag	86.1	-	-	-	569.1	-	-	36.2	-	132.3	823.7	12.0
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S	115.5	-	29.9	37.8	1,019.9	4,192.3	1,331.1	181.9	21.4	-	6,929.8	3,330.
24a	Return Flow for Delta Outflow - Ag	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S	-	-	-	-	4,835.4	-	-	-	-	-	4,835.4	2,331.
c	Return Flow for Delta Outflow - Urban Wastewater	-	-	-	-	-	-	-	-	-	-	0.0	-
25	Direct Diversions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
26	Surface Water in Storage - Beg of Yr	2,740.7	530.5	770.2	1,515.5	11,603.3	7,378.6	708.7	903.5	326.2	585.4	27,062.6	12,504.
27	Groundwater Extractions - Banked	-	-	-	-	-	-	-	-	-	-	0.0	-
28	Groundwater Extractions - Adjudicated	-	-	-	824.7	-	-	-	-	61.8	-	886.5	-
29	Groundwater Extractions - Unadjudicated	335.4	142.8	1,085.3	696.2	2,803.1	2,655.6	5,024.7	161.6	277.6	304.4	13,486.7	61.2
Withdrawals:	**In Thousand Acre-feet**												
23	Groundwater Subsurface Outflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	-
30	Surface Water Storage - End of Yr	2,495.0	505.7	778.5	1,643.3	10,502.6	7,446.0	652.2	837.6	317.8	566.9	25,745.6	11,702.
31	Groundwater Recharge-Contract Banking	-	-	-	-	-	-	167.4	-	-	-59.2	108.2	-
32	Groundwater Recharge-Adjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
33	Groundwater Recharge-Unadjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
34a	Evaporation and Evapotranspiration from Native Vegetation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
b	Evaporation and Evapotranspiration from Unirrigated Ag	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
35a	Evaporation from Lakes	45.2	10.1	11.6	18.5	331.5	89.7	38.5	313.6	163.7	1,552.5	2,574.9	107.2
b	Evaporation from Reservoirs	181.3	103.4	75.9	164.2	798.5	477.1	233.8	213.7	45.1	121.5	2,414.5	711.0
36	Ag Effective Precipitation on Irrigated Lands	129.0	-	-	-	1,058.3	N/A	-	32.1	-	-	1,219.4	51.9
37	Agricultural Use	785.3	122.7	994.8	911.6	7,930.8	6,542.1	10,013.0	462.4	360.9	3,732.4	31,856.0	329.7
38	Wetlands Use	424.4	6.2	0.1	38.1	429.5	441.6	73.8	25.9	-	30.2	1,469.8	-
39a	Urban Residential Use - Single Family - Interior	30.7	131.0	70.0	1,249.0	127.4	103.1	121.1	4.2	98.1	108.5	2,043.1	28.9
b	Urban Residential Use - Single Family - Exterior	40.0	305.9	77.8	760.8	267.7	191.2	185.1	5.1	67.8	119.8	2,021.2	60.1
c	Urban Residential Use - Multi-family - Interior	13.8	184.9	36.9	541.3	88.0	89.9	127.7	4.8	23.7	10.2	1,121.2	10.1
d	Urban Residential Use - Multi-family - Exterior	3.1	46.2	20.4	142.5	22.2	44.9	76.4	1.2	11.6	9.5	378.0	3.6
40	Urban Commercial Use	16.0	223.2	54.0	918.6	140.3	38.0	44.6	9.7	16.8	96.0	1,557.3	10.5
41	Urban Industrial Use	27.6	55.9	22.5	210.2	84.4	36.1	63.8	12.5	4.8	4.7	522.5	10.3
42	Urban Large Landscape	12.8	91.2	12.6	241.0	111.6	37.2	19.2	2.6	8.0	157.5	693.7	11.0
43	Urban Energy Production	-	-	14.3	39.8	0.3	-	-	-	6.3	76.7	137.4	-
44	Instream Flow	1,444.5	21.5	21.4	3.5	3,759.8	2,098.5	-	85.0	88.8	-	7,523.0	1,563.
45	Required Delta Outflow	-	-	-	-	7,231.6	-	-	-	-	-	7,231.6	-
46	Wild & Scenic Rivers Use	17,321.1	-	103.2	34.3	2,024.7	2,093.8	1,331.1	233.3	-	-	23,141.5	4,098.
47a	Evapotranspiration of Applied Water - Ag	557.8	94.7	695.7	646.2	5,008.5	4,405.8	7,162.0	301.3	247.6	2,617.9	21,737.5	248.6
b	Evapotranspiration of Applied Water - Managed Wetlands	194.4	3.1	0.1	38.1	169.7	148.1	41.5	19.8	-	30.2	645.0	-
c	Evapotranspiration of Applied Water - Urban	44.2	307.9	102.2	1,144.3	371.1	211.2	223.3	8.7	87.4	292.1	2,792.4	54.5
48	Evaporation and Evapotranspiration from Urban Wastewater	0.2	-	-	-	0.1	-	-	-	-	-	0.3	-
49	Return Flows Evaporation and Evapotranspiration - Ag	33.5	-	4.3	15.1	173.4	11.6	-	20.2	7.3	89.7	355.1	7.8
50	Urban Waste Water Produced	75.6	598.4	50.2	2,162.1	301.0	82.9	-	26.5	35.3	66.5	3,398.5	50.7
51a	Conveyance Evaporation and Evapotranspiration - Urban	-	6.9	9.6	374.7	4.3	16.0	12.8	-	10.5	24.3	459.1	9.6
b	Conveyance Evaporation and Evapotranspiration - Ag	7.1	0.6	14.5	-	61.5	252.6	482.0	1.7	-	64.0	884.0	23.9
c	Conveyance Evaporation and Evapotranspiration - Managed Wetland	0.4	-	-	-	16.3	-	-	0.3	-	-	17.0	-
d	Conveyance Loss to Mexico	-	-	-	-	-	-	-	-	-	N/A	0.0	-
52a	Return Flows to Salt Sink - Ag	41.9	28.6	45.2	135.5	848.7	282.5	587.1	76.9	65.5	1,082.4	3,194.3	77.6
b	Return Flows to Salt Sink - Urban	76.5	693.3	108.1	2,352.1	371.7	119.3	-	16.1	72.0	196.1	4,005.2	71.6
c	Return Flows to Salt Sink - Wetlands	1.7	3.1	-	-	164.0	-	-	0.6	-	-	169.4	-
53	Remaining Natural Runoff - Flows to Salt Sink	18,763.0	21.5	94.7	-	10,924.2	-	-	141.2	67.4	-	30,012.0	0.0
54a	Outflow to Nevada	-	-	-	-	-	-	-	753.9	-	-	753.9	-
b	Outflow to Oregon	113.7	-	-	-	-	-	-	-	-	-	113.7	-
c	Outflow to Mexico	-	-	-	-	-	-	-	-	-	-	0.0	-
55	Regional Imports	2.0	309.2	143.7	3,141.1	668.5	5,287.6	5,579.4	0.3	836.1	5,449.4	21,417.3	0.0
56	Regional Exports	668.5	0.0	88.9	0.0	5,114.3	5,848.3	1,614.4	11.8	1,000.5	1,296.0	15,642.7	3,744.
59	Groundwater Net Change in Storage	-28.4	114.5	-767.3	-1,406.1	-150.8	-97.2	-1,837.5	-41.3	-282.3	-188.5	-4,684.9	-15.1
60	Surface Water Net Change in Storage	-245.7	-24.8	8.3	127.8	-1,100.7	67.4	-56.5	-65.9	-8.4	-18.5	-1,317.0	-802.0
61	Surface Water Total Available Storage	3,779.9	746.1	1,226.8	3,058.8	16,145.6	11,477.1	2,046.1	1,181.2	458.9	620.4	40,740.9	18,185.

N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 1-2c
California Statewide Water Portfolios for Water Year 2001

he flow diagram is regional data only.

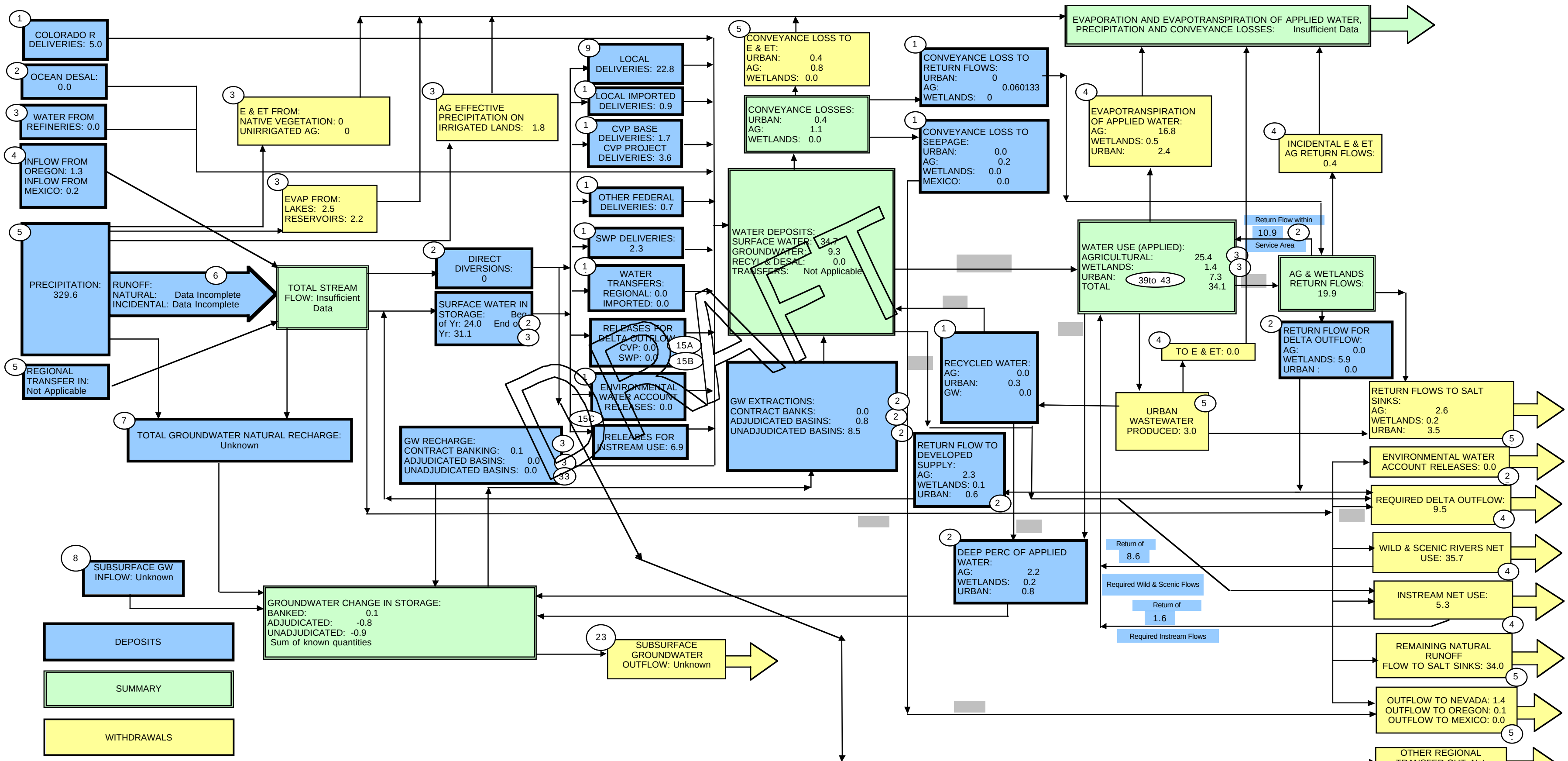
puts:	In Thousand Acre-feet	NC 2001	SF 2001	CC 2001	SC 2001	SR 2001	SJ 2001	TL 2001	NL 2001	SL 2001	CR 2001	CA 2001	MC 2001
1	Colorado River Deliveries	-	-	-	1,202.0	-	-	-	-	-	3,946.9	5,148.9	-
2	Total Desalination	-	-	-	-	-	-	-	-	-	-	0.0	-
3	Water from Refineries	-	-	-	-	-	-	-	-	-	-	0.0	-
4a	Inflow From Oregon	1,226.2	-	-	-	-	-	-	-	-	-	1,226.2	-
b	Inflow From Mexico	-	-	-	-	-	-	-	-	-	154.7	154.7	-
5	Precipitation	31,254.4	4,908.0	11,847.9	9,327.0	35,894.8	16,120.2	11,563.6	3,755.9	9,740.9	4,769.9	139,182.6	23,444.5
6a	Runoff - Natural	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
b	Runoff - Incidental	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
7	Total Groundwater Natural Recharge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
8	Groundwater Subsurface Inflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
9	Local Deliveries	351.1	231.7	45.4	217.1	8,823.5	3,381.8	1,713.4	311.8	46.8	4.0	15,126.6	1,062.9
10	Local Imports	16.4	529.9	-	252.5	8.5	-	-	3.3	-	-	810.6	8.5
11a	Central Valley Project :: Base Deliveries	-	-	35.5	-	2,021.3	168.2	-	-	-	-	2,225.0	7.0
b	Central Valley Project :: Project Deliveries	-	114.7	19.6	-	495.7	1,545.2	1,790.5	-	-	-	3,965.7	11.4
12	Other Federal Deliveries	238.2	37.7	54.6	0.7	239.5	96.4	-	-	-	-	667.1	1.6
13	State Water Project Deliveries	-	121.3	27.7	1,056.0	19.6	3.5	849.3	-	79.1	43.9	2,200.4	-
14a	Water Transfers - Regional	-	0.2	-	-	-	-	-	-	-	-	0.2	-
b	Water Transfers - Imported	-	-	-	-	-	-	-	-	-	-	0.0	-
15a	Releases for Delta Outflow - CVP											0.0	
b	Releases for Delta Outflow - SWP											0.0	
c	Instream Flow	1,473.5	20.0	10.8	3.5	3,747.5	1,424.4	-	84.5	78.4	-	6,842.6	1,450.6
16	Environmental Water Account Releases	-	-	-	-	242.0	-	-	-	-	-	242.0	-
17a	Conveyance Return Flows to Developed Supply - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Return Flows to Developed Supply - Ag	-	-	-	-	45.3	-	-	-	-	-	45.3	-
c	Conveyance Return Flows to Developed Supply - Managed Wetlands	-	-	-	-	-	-	-	-	-	-	0.0	-
18a	Conveyance Seepage - Urban	-	-	-	-	-	-	-	-	-	-	0.0	-
b	Conveyance Seepage - Ag	4.9	-	-	-	268.2	6.7	-	2.1	-	-	281.9	3.7
c	Conveyance Seepage - Managed Wetlands	-	-	-	-	13.4	-	-	-	-	-	13.4	-
19a	Recycled Water - Agriculture	11.7	10.3	-	-	-	1.2	-	5.0	-	-	28.2	1.2
b	Recycled Water - Urban	0.4	5.9	18.5	188.7	-	0.7	-	-	29.4	17.8	261.4	-
c	Recycled Water - Groundwater	-	6.2	-	36.3	-	-	-	-	-	-	42.5	-
20a	Return Flow to Developed Supply - Ag	6.9	-	-	-	957.6	628.2	-	-	-	-	1,592.7	-
b	Return Flow to Developed Supply - Wetlands	-	-	-	-	4.4	134.2	2.0	-	-	-	140.6	-
c	Return Flow to Developed Supply - Urban	3.5	-	32.6	415.4	13.3	-	-	1.8	79.0	211.9	757.5	-
21a	Deep Percolation of Applied Water - Ag	72.2	-	288.8	92.6	320.3	910.1	2,075.5	29.3	38.4	76.6	3,903.8	4.5
b	Deep Percolation of Applied Water - Wetlands	0.7	-	-	-	12.3	142.3	34.6	0.3	-	-	190.2	-
c	Deep Percolation of Applied Water - Urban	18.6	46.1	64.4	-	90.8	226.0	431.6	12.6	-	-	890.1	18.3
22a	Reuse of Return Flows within Region - Ag	23.5	-	-	-	446.2	-	-	30.8	-	135.3	635.8	6.9
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S	30.3	-	36.2	111.7	619.3	2,515.4	964.0	126.9	20.6	-	4,424.4	1,783.0
24a	Return Flow for Delta Outflow - Ag	-	-	-	-	219.7	-	-	-	-	-	219.7	-
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S	-	-	-	-	4,098.4	-	-	-	-	-	4,098.4	1,636.4
c	Return Flow for Delta Outflow - Urban Wastewater	-	-	-	-	-	-	-	-	-	-	0.0	-
25	Direct Diversions	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
26	Surface Water in Storage - Beg of Yr	2,495.0	505.7	778.5	1,643.3	10,502.6	7,446.0	652.2	837.6	317.8	566.9	25,745.6	11,702.6
27	Groundwater Extractions - Banked	-	-	-	-	-	-	-	-	-	-	0.0	-
28	Groundwater Extractions - Adjudicated	-	-	-	829.2	-	-	-	-	61.8	-	891.0	-
29	Groundwater Extractions - Unadjudicated	462.7	217.6	1,222.9	627.9	2,922.7	2,954.9	6,974.5	234.9	293.7	307.9	16,219.7	73.9
ithdrawals:	In Thousand Acre-feet												
23	Groundwater Subsurface Outflow	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	-
30	Surface Water Storage - End of Yr	2,003.9	449.4	764.5	1,975.6	8,090.8	6,010.8	511.4	407.8	316.5	568.3	21,099.0	8,982.1
31	Groundwater Recharge-Contract Banking	-	-	-	-	-	-	-3.9	-	-	-8.9	-12.8	-
32	Groundwater Recharge-Adjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
33	Groundwater Recharge-Unadjudicated Basins	-	-	-	-	-	-	-	-	-	-	0.0	-
34a	Evaporation and Evapotranspiration from Native Vegetation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
b	Evaporation and Evapotranspiration from Unirrigated Ag	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A
35a	Evaporation from Lakes	42.4	9.8	10.9	17.9	326.1	82.0	34.2	317.6	163.4	1,552.4	2,556.7	98.5
b	Evaporation from Reservoirs	162.7	98.8	71.5	160.8	728.9	449.3	190.6	267.6	42.1	120.6	2,292.9	646.4
36	Ag Effective Precipitation on Irrigated Lands	122.7	-	-	-	1,056.4	N/A	-	8.5	-	-	1,187.6	70.8
37	Agricultural Use	633.4	135.6	1,146.4	758.4	7,781.6	6,695.3	9,983.1	428.4	343.9	3,663.6	31,569.7	305.9
38	Wetlands Use	254.3	6.2	0.1	37.2	445.5	411.7	76.3	20.5	-	29.6	1,281.4	-
39a	Urban Residential Use - Single Family - Interior	30.3	137.2	69.9	1,197.1	132.9	108.4	126.3	3.7	94.9	147.6	2,048.3	30.0
b	Urban Residential Use - Single Family - Exterior	42.1	320.2	72.8	677.8	280.0	203.9	192.7	5.9	73.8	90.4	1,959.6	62.6
c	Urban Residential Use - Multi-family - Interior	15.0	194.6	32.7	503.2	90.4	93.8	132.8	5.0	12.7	9.7	1,089.9	10.5
d	Urban Residential Use - Multi-family - Exterior	3.7	48.6	17.0	163.3	22.7	46.1	79.7	1.3	7.2	10.1	399.7	3.8
40	Urban Commercial Use	17.3	234.6	46.3	909.8	136.4	40.2	46.3	9.3	18.1	151.3	1,609.6	11.2
41	Urban Industrial Use	27.7	58.6	20.9	209.4	84.4	36.8	66.4	12.5	5.5	4.9	527.1	10.4
42	Urban Large Landscape	13.5	95.5	13.6	176.8	119.7	39.5	19.8	2.6	9.0	105.7	595.7	11.6
43	Urban Energy Production	0.1	-	14.3	39.8	0.1	-	-	-	6.3	76.7	137.3	-
44	Instream Flow	1,473.5	20.0	10.8	3.5	3,747.5	1,424.4	-	84.5	78.4	-	6,842.6	1,450.6
45	Required Delta Outflow	-	-	-	-	4,486.2	-	-	-	-	-	4,486.2	-
46	Wild & Scenic Rivers Use	6,547.6	-	73.9	108.2	885.0	1,091.0	964.0	152.5	-	-	9,822.2	1,968.8
47a	Evapotranspiration of Applied Water - Ag	460.6	104.2	789.1	540.7	4,913.7	4,627.6	7,320.4	281.1	239.1	2,594.8	21,871.3	205.9
b	Evapotranspiration of Applied Water - Managed Wetlands	155.3	3.1	0.1	37.2	162.9	135.1	38.4	16.9	-	29.6	578.6	-
c	Evapotranspiration of Applied Water - Urban	48.3	322.6	94.4	1,017.9	383.6	219.9	232.4	9.4	90.1	206.2	2,624.8	56.7
48	Evaporation and Evapotranspiration from Urban Wastewater	0.2	-	-	-	0.2	-	-	-	-	-	0.4	-
49	Return Flows Evaporation and Evapotranspiration - Ag	26.4	-	4.9	12.5	173.9	14.3	-	12.5	6.7	85.6	336.8	6.0
50	Urban Waste Water Produced	77.7	628.5	46.3	2,036.3	311.6	92.9	-	26.5	33.3	68.2	3,321.3	52.7
51a	Conveyance Evaporation and Evapotranspiration - Urban	-	6.2	9.4	359.8	4.3	15.7	13.3	-	10.1	18.9	437.7	9.6
b	Conveyance Evaporation and Evapotranspiration - Ag	4.2	0.7	16.5	-	59.9	248.1	382.1	1.0	-	64.0	776.5	22.7
c	Conveyance Evaporation and Evapotranspiration - Managed Wetland	0.1	-	-	-	15.5	-	-	0.2	-	-	15.8	-
d	Conveyance Loss to Mexico	-	-	-	-	-	-	-	-	-	N/A	0.0	-
52a	Return Flows to Salt Sink - Ag	43.8	32.1	50.0	112.7	939.6	380.6	537.5	74.7	59.7	1,045.9	3,276.6	104.2
b	Return Flows to Salt Sink - Urban	79.1	726.8	105.5	2,237.0	380.2	132.2	-	16.5	66.7	198.9	3,942.9	74.2
c	Return Flows to Salt Sink - Wetlands	1.5	3.1	-	-	169.4	-	0.5	-	-	-	174.5	-
53	Remaining Natural Runoff - Flows to Salt Sink	8,021.1	20.0	48.5	-	2,457.9	-	-	113.2	57.8	-	10,718.5	0.0
54a	Outflow to Nevada	-	-	-	-	-	-	-	551.9	-	-	551.9	-
b	Outflow to Oregon	66.4	-	-	-	-	-	-	-	-	-	66.4	-
c	Outflow to Mexico	-	-	-	-	-	-	-	-	-	-	0.0	-
55	Regional Imports	2.0	273.9	180.0	2,763.0	668.5	3,890.3	3,784.6	3.3	533.9	5,192.8	17,292.3	0.0
56	Regional Exports	668.5	0.0	132.7	0.0	3,761.4	4,073.1	1,295.0	9.2	706.6	1,202.0	11,848.5	2,605.6
59	Groundwater Net Change in Storage	-156.8	-150.7	-868.7	-1,364.5	-1,146.6	-1,332.3	-4,176.8	-177.5	-303.5	-200.7	-9,878.0	-78.2
60	Surface Water Net Change in Storage	-491.1	-56.3	-14.0	332.3	-2,411.8	-1,435.2	-140.8	-429.8	-1.3	1.4	-4,646.6	-2,720.5
61	Surface Water Total Available Storage	3,779.9	746.1	1,226.8	3,058.8	16,145.6	11,477.1	2,046.1	1,181.2	458.9	620.4	40,740.9	18,185.0

N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 1-3
California Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	0.6			0.7			0.6		
Commercial	1.2			1.6			1.6		
Industrial	0.5			0.5			0.5		
Energy Production	0.1			0.1			0.1		
Residential - Interior	2.8			3.2			3.1		
Residential - Exterior	2.1			2.4			2.4		
Evapotranspiration of Applied Water		2.4	2.4		2.8	2.8		2.6	2.6
Irrecoverable Losses		0.6	0.6		0.7	0.7		0.7	0.7
Outflow		3.1	3.1		3.5	3.5		3.4	3.4
Conveyance Loss - Applied Water	0.2			0.2			0.2		
Conveyance Loss - Evaporation		0.2	0.2		0.2	0.2		0.2	0.2
Conveyance Loss - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Loss - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.2			0.1			0.1		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**7.7**	**6.4**	**6.4**	**8.8**	**7.3**	**7.3**	**8.6**	**7.0**	**7.0**
Agriculture									
On-Farm Applied Water	24.3			31.2			31.3		
Evapotranspiration of Applied Water		16.8	16.8		21.7	21.7		21.9	21.9
Irrecoverable Losses		0.8	0.8		0.9	0.9		0.9	0.9
Outflow		3.9	1.6		4.0	2.1		4.0	2.5
Conveyance Loss - Applied Water	2.2			2.4			2.2		
Conveyance Loss - Evaporation		0.8	0.8		0.9	0.9		0.8	0.8
Conveyance Loss - Irrecoverable Losses		0.2	0.2		0.2	0.2		0.2	0.2
Conveyance Loss - Outflow		0.4	0.3		0.4	0.3		0.4	0.3
GW Recharge Applied Water	1.1			0.7			0.2		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**27.5**	**22.8**	**20.5**	**34.3**	**28.1**	**26.2**	**33.8**	**28.1**	**26.5**
Environmental									
Instream									
Applied Water	6.9			7.5			6.8		
Outflow		5.3	5.3		5.4	5.4		5.4	5.4
Wild & Scenic									
Applied Water	44.3			23.1			9.8		
Outflow		35.7	35.7		18.5	18.5		6.9	6.9
Required Delta Outflow									
Applied Water	9.5			7.2			4.5		
Outflow		9.5	9.5		7.2	7.2		4.5	4.5
Managed Wetlands									
Habitat Applied Water	1.4			1.5			1.3		
Evapotranspiration of Applied Water		0.5	0.5		0.6	0.6		0.6	0.6
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.5	0.3		0.4	0.3		0.4	0.3
Conveyance Loss - Applied Water	0.0			0.0			0.0		
Conveyance Loss - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Loss - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Loss - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	1.4	1.0	0.8	1.5	1.1	1.0	1.3	1.0	0.9
Total Environmental Use	**62.1**	**51.5**	**51.4**	**39.4**	**32.2**	**32.1**	**22.5**	**17.8**	**17.7**
TOTAL USE AND LOSSES	**97.4**	**80.7**	**78.3**	**82.5**	**67.6**	**65.5**	**64.8**	**52.9**	**51.2**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	22.8	22.8	21.3	19.6	19.6	18.4	15.1	15.1	14.2
Local Imported Deliveries	0.9	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.8
Colorado River Deliveries	5.0	5.0	4.7	5.3	5.3	5.0	5.1	5.1	4.8
CVP Base and Project Deliveries	5.4	5.4	5.0	6.8	6.8	6.4	6.2	6.2	5.8
Other Federal Deliveries	0.7	0.7	0.6	0.8	0.8	0.8	0.7	0.7	0.6
SWP Deliveries	2.3	2.3	2.2	3.7	3.7	3.5	2.2	2.2	2.1
Required Environmental Instream Flow	39.0	39.0	39.0	22.2	22.2	22.2	11.2	11.2	11.2
Groundwater									
Net Withdrawal	4.4	4.4	4.4	8.2	8.2	8.2	11.3	11.3	11.3
Artificial Recharge	1.1			0.7			0.2		
Deep Percolation	3.8			5.5			5.6		
Reuse/Recycle									
Reuse Surface Water	11.7			8.7			6.1		
Recycled Water	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
TOTAL SUPPLIES	**97.4**	**80.7**	**78.3**	**82.5**	**67.6**	**65.5**	**64.9**	**52.9**	**51.2**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 1-2
California Statewide 1998 Flow Diagram
In Thousand Acre-Feet (TAF)



May 25, 2004

Figure 1-3
California Statewide 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

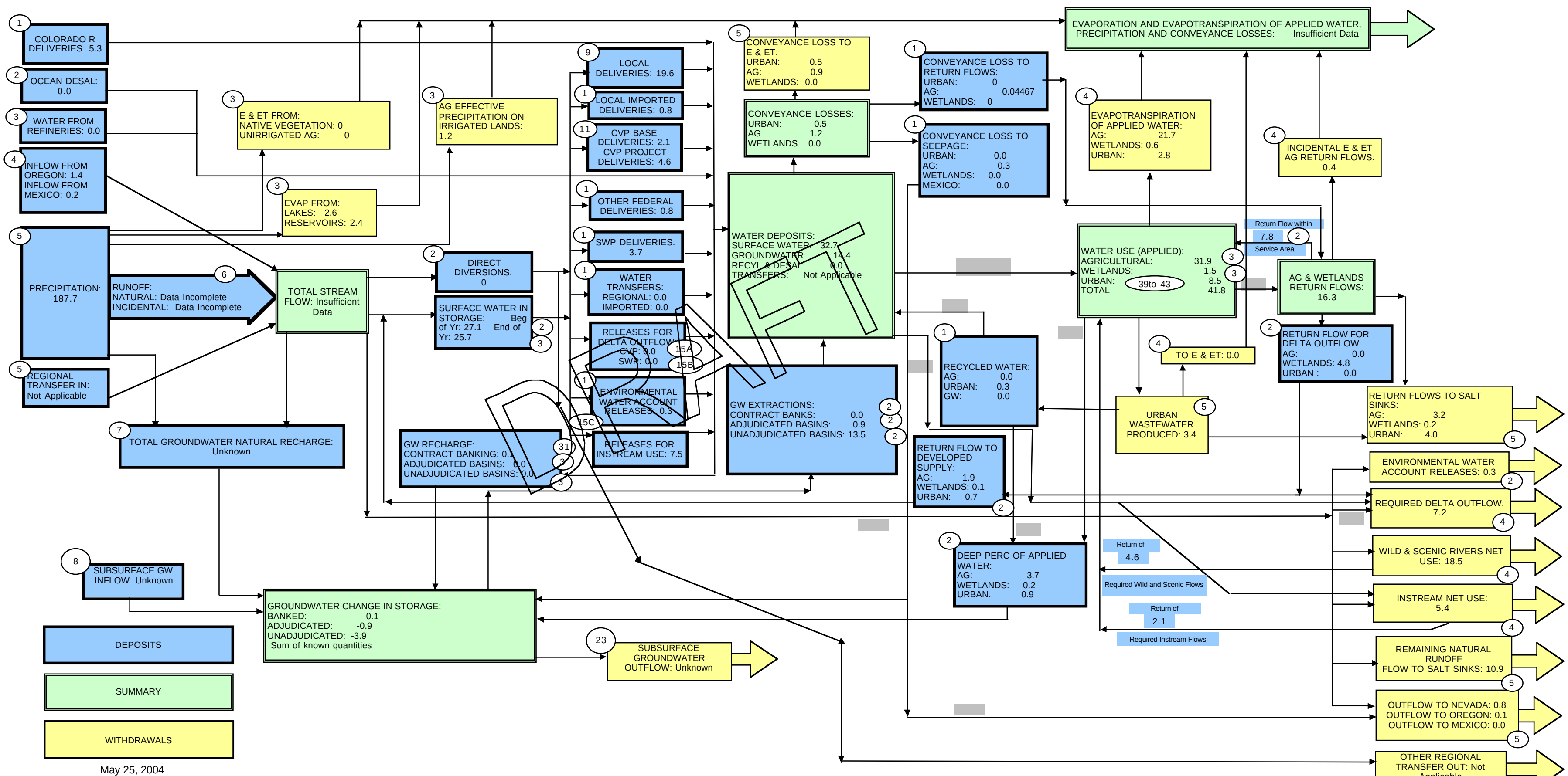
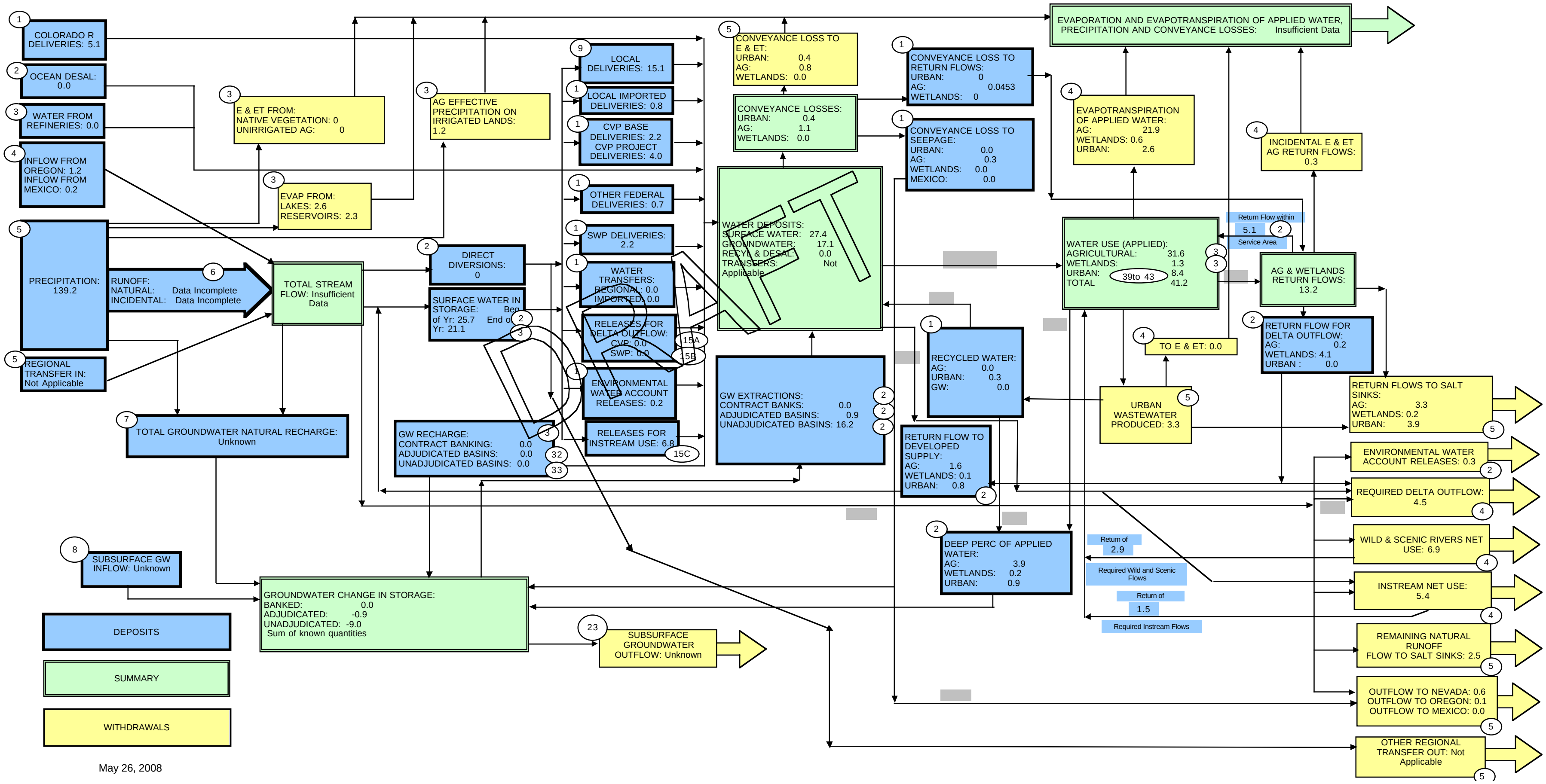


Figure 1-4
California Statewide 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



May 26, 2008

Chapter 2. North Coast Hydrologic Region

Setting

The North Coast Region encompasses redwood forests, inland mountain valleys, and the arid Modoc Plateau. The region includes all or large portions of Modoc, Siskiyou, Del Norte, Trinity, Humbolt, Mendocino, Lake, and Sonoma Counties (Figure 2-1). It also includes small areas of Shasta, Tehama, Glenn, Colusa, and Marin Counties. The region extends from Tomales Bay to the Oregon border -- about 400 miles along the Pacific -- then east along the border to just east of Goose Lake. It covers 20,000 square miles, or more than 12 percent of the state. Most of the region is mountainous and rugged. The mountain crests, which form the eastern boundary of the region, are about 6,000 feet elevation with a few peaks higher than 8,000 feet. Only 13 percent of the land is valley or mesa, and more than half of that is in the higher northeastern part of the region in the upper Klamath River Basin.

Climate

Heavy rainfall makes the region the most water-abundant area of California, producing about 41 percent of the State's total natural runoff. Annual average precipitation in the region is 53 inches, ranging from more 100 inches in eastern Del Norte County to less than 15 inches in the Lost River drainage area of Modoc County. There is relatively little snow, and it usually stays on the ground only a short time at 4,000 feet and higher.

The average annual runoff is about 29 million acre-feet, or enough water to fill the state's largest reservoir, Shasta Lake, nearly six times.

Population

The 2000 population was about 644,000. Most urban development is in the Santa Rosa, Ukiah and Eureka areas.

Land Use

Forest and rangeland represent about 98 percent of the land area of the region. Much of the region is in national forests, state and national parks, and land under the jurisdiction of the Bureau of Land Management and in Indian reservations. The major land uses in the North Coast Region are timber production, agriculture, fish and wildlife propagation, parks, recreation and open space. However, over-cutting of timber and environmental constraints have depressed the timber industry.

Vacationers, boaters, anglers, and sightseers are attracted by the region's 400 miles of scenic ocean shoreline, including nearby forests with more than half of California's redwoods. Inland there are mountains, including 10 wilderness areas run by the U.S. Forest Service. It has more than 40 state parks, numerous Forest Service campgrounds, the Smith River National Recreation Area and the Redwood National Park. It is an area of rugged natural beauty with some of the most renowned fishing in North America. The various recreation destinations have developed their own small water supplies, including wells, springs and streams.

Climate, soils, water supply, and remoteness from markets limit profitable crops throughout most of the North Coast region. In the inland valley areas, there is more irrigable land than can be irrigated with existing supplies. The agricultural trend in the past decade has been one of land consolidation and loss of prime agricultural land to urban and slow growth. This reflects the low crop values, lower quality agricultural land, and lack of additional cheap surface water supplies and use of only the most economically developable groundwater sources.

Irrigated agriculture in the North Coast Region uses most of the region's water. Irrigation today accounts for about 81 percent of the region’s water use, while municipal and industrial use is only about 19 percent. About 264,500 acres, or about 2 percent of the region, is irrigated. Of that, 225,900 acres are in the Upper Klamath River where the main irrigated crops are pasture and alfalfa, grain, and potatoes. The highest-value crops in the region are the substantial acres of grapes and orchards in the Russian River Basin and ornamental flowers, including bulbs, in Del Norte County.

The acreage of orchards has decreased over the past several decades. For example, in Sonoma County, orchards declined from 20,000 acres in 1971 to fewer than 3,500 in 2001. But irrigation water used on orchards did not decrease in the same proportion because many of the apple, prune and walnut orchards taken out of production were not irrigated. As the acreage orchards declined, vineyard acreage increased. Most new vineyards use drip irrigation systems. Vineyards use overhead sprinklers for frost protection in the spring and for post-harvest irrigation in the fall.

Many of the region’s watersheds support listed species of plants and animals, and many North Coast streams and rivers support anadromous fish runs. The principal reaches of the Klamath, Eel, and Smith Rivers have been designated wild and scenic under federal and State law and therefore are protected from additional large-scale water development.

Water Supply and Use

Communities and rural areas are generally supplied by small local surface and groundwater systems. Larger water supply projects include the Bureau of Reclamation’s Klamath Project, the Army Corps of Engineers’ Russian River Project, and the Humboldt Bay Municipal Water District’s Ruth Reservoir and Eureka to McKinleyville distribution system. Supplies from the largest reservoirs in the region, the Central Valley Project’s Trinity Lake and the USCE’s Lake Sonoma near Geyserville, were built as export projects to adjacent hydrologic regions. Many groundwater wells rely on hydrologic connection to the rivers and streams of the valleys. Along the coast valleys, most “groundwater” is developed from shallow wells installed in the narrow river terraces adjacent to the river and streams.

The principal uses of environmental water occur in the Lower Klamath, Tule Lake, and Clear Lake National Wildlife Refuges and the Butte Valley and Shasta Valley Wildlife Areas. In Butte Valley, most of the water for wildlife comes from about 3,000 acre-feet of groundwater. Streams, rivers, lakes and reservoirs serve other refuges and wildlife areas in the region.

Through the California Wild and Scenic Rivers Act of 1972, Californians determined that most water in the North Coast Region would remain in the rivers to preserve their free-flowing character and provide for environmental uses. Most of the Eel, Klamath, and Smith Rivers are wild and scenic, which protests their free-flowing pristine character. Additional water may be reallocated to the Trinity, depending on the results of an ongoing 22-year flow evaluation by U.S. Fish and Wildlife Service. A court had ordered an environmental impact report completed by mid-April, 2003. However, issues surrounding the amount of water to be released from the Central Valley Project to the Trinity River remain unresolved.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, required ocean outflow is the largest use of water in the region. More water is exported to other regions than is consumptively used in the North Coast Region.

State of the Region

The North Coast Region generally has good water quality that adequately supports the beneficial uses of its water bodies, including commercial and recreational fishing, shellfish harvesting, and recreation. Many of the region's watersheds preserve listed species of plants and animals, and many North Coast streams and rivers sustain anadromous fish runs. The region features important coastal resources, including Bodega Harbor and Humboldt Bay, as well as small estuaries.

Challenges

The region nonetheless is confronted by many water quality challenges. The RWQCB's priorities highlight control of nonpoint source runoff from logging, rural roads, agriculture (including grazing), and cities; such runoff causes erosion and sedimentation affecting habitat for spawning and rearing of anadromous fish, or microbial contamination of shellfish (in particular, oyster) growing areas. In fact, sediment, temperature, and nutrients are nearly the sole focus of the region's 303(d) list of impaired water bodies. While water may begin in pristine condition, the region is characterized by rugged, steep, forested lands, with highly erodable, loosely consolidated soils, heavy precipitation, and extensive timber harvesting. Channel modification and water diversions have radically changed water quality conditions in many water bodies in the region. The development of new hillside vineyards is an increasing source of erosion, as well as pesticides. Wildfires and timber salvage, and subsequent erosion, result in sedimentation and landslides.

Fisheries in the region can be adversely affected by a number of water quality factors. The Eel, Mad, and Trinity Rivers, as well as the Garcia River and Redwood Creek, suffer from sedimentation, which can smother salmonid spawning areas. The North Coast Region's basin plan sets turbidity restrictions to control erosion impacts from logging and related activities, such as road building. Timber harvests can also decrease the canopy shading rivers and streams, thereby increasing water temperatures to levels that are detrimental to cold water fisheries. The basin plan also specifically establishes temperature objectives for the Trinity River, in which reduced flows have disrupted temperature and physical cues for anadromous fish runs. Because of water diversions, summer temperatures in the Trinity as well as the Klamath can be lethal to salmonids. Fisheries can be further adversely affected by the lack of woody debris for pool habitat and sediment metering.

The basin plan requires tertiary treatment of wastewater discharges to the Russian River, a major source of domestic water, and establishes limits on bacteriological contamination of shellfish growing areas along the coast. The plan also prohibits or strictly limits waste discharges to the Klamath, Trinity, Smith, Mad, and Eel Rivers, as well as estuaries and other coastal waters. Nonpoint source runoff, especially after precipitation, close shellfish harvesting beds in Humboldt Bay. Stormwater runoff may also be contributing to high ammonia and low dissolved oxygen levels in Laguna de Santa Rosa, threatening aquatic life. Mercury in fish tissue is an issue in Lakes Pillsbury, Mendocino, and Sonoma; a health advisory for mercury has been issued for Lake Pillsbury.

Regional groundwater quality problems include seawater intrusion and nitrates in shallow coastal groundwater aquifers, salinity and alkalinity in the lake sediments of the Modoc Plateau basins, and iron, boron, and manganese in the inland basins of Mendocino and Sonoma counties. Septic tank failures in western Sonoma County, at Monte Rio and Camp Meeker, and along the Trinity below Lewiston Dam, are a concern for recreation water quality. Recreational use of Trinity, Lewiston, and Ruth Lakes present concerns fuel constituents such as MTBE. Abandoned mines, forest herbicide application and historical discharge of wood treatment chemicals at lumber mills, including the Sierra Pacific Industries site near Arcata and Trinity River Lumber Co in Weaverville, are also regional issues of concern. Of note, according to the 305(b) report, only the Russian River basin has a long-term water quality dataset.

Even though the North Coast Region produces a substantial share of California's surface water runoff, only about 10 percent of this runoff occurs in the summer months and water supplies are limited throughout much of the area. Small surface water supply projects generally have limited carryover capacity that cannot supply adequate water during extended months of low rainfall. The drinking water for many of the communities on the North Coast, such as Klamath, Smith River, Crescent City, and most of the Humboldt Bay area, is supplied by Ranney collectors (horizontal wells adjacent to or under the bed of a stream). Erosion is undercutting some of these collectors, such as those in the Mad River supplying the Humboldt Bay Municipal Water District (which serves Eureka, Arcata, and McKinleyville). As such, these "wells" may actually be under the direct influence of surface water, which would require their filtration.

The Russian River provides domestic water to over a half million people, including Santa Rosa and Ukiah, as well as southern Sonoma County and large portions of Marin County. The City of Willits has had chronic problems with turbidity, and taste and odor with water from Morris Reservoir, and high arsenic, iron, and manganese levels in its well supply. Organic chemical contamination have closed municipal wells in the cities of Sebastopol and Santa Rosa. During dry years, seawater intrudes into the domestic water supply wells serving the town of Klamath, which are located along the Klamath River.

The Town of Mendocino typifies the problems related to groundwater development in the shallow marine terrace aquifers; surveys in the mid-1980s indicate that about 10 percent of wells go dry every year and up to 40 percent go dry during drought years.

A significant change in use of the Region's water was approved by the Secretary of the Interior in December, 2000. As part of an effort to restore Trinity River fisheries, the Secretary made a decision to increase Trinity River instream flows from 340,000 acre-feet per year (roughly one quarter of average annual flow at the CVP diversion point on the Trinity River) to an average of 595,000 acre-feet per year. This decision, which would reduce the amount of water available for export from the Trinity River to the Central Valley, is the subject of litigation. Implementation of the new flow regime has been stayed by an injunction pending completion of a Supplemental EIS, scheduled for mid-2004.

The primary water management issue in the Klamath River Basin is the restoration of fish populations that include listed species such as the Lost River and shortnose suckers, Coho salmon and steelhead trout. Studies have not yet shown how to accommodate the needs of both agriculture and fisheries. Some studies indicate that higher water levels in Upper Klamath Lake are an aid to recovery of the two sucker species. The modified operation of the Klamath Project to accommodate the needs of the listed suckers has reduced the river flows that are critical to salmon and steelhead survival in the middle and lower

Klamath. In 2001 during a severe drought, the USBR delivered about 75,000 acre-feet of water to agriculture in California, about 25 percent of the normal supply. In the Tule Lake and Lower Klamath Lake sub basins, this translated to a drought disaster for both agriculture and the wildlife refuges. In 2002, approximately 33,000 adult salmon died trying to swim up the Klamath due to water quality problems. Water supply implications of the Coho and steelhead listings will not be known until management plans are completed and recovery goals are established.

The Eel River complex, the largest river system draining to Humboldt County's coast (and third-largest in California), is plagued by massive sediment loads from unstable soils and heavy rains. Water quality decreases downstream. The Eel River is also host to Humboldt County's largest fisheries. In many streams, adadromous fish are no longer able to reach spawning grounds. Nearly all major waterways are host to anadromous fisheries, particularly Chinook and Coho salmon and cutthroat and steelhead trout, which are adversely affected by water quality and quantity issues.

Accomplishments

In early 1998 the city of Santa Rosa selected an alternative that would recharge depleted geothermal fields in the Geysers area with treated wastewater as part of its long-term wastewater-recycling program. Under this alternative, the Santa Rosa Subregional Sewage System will pump about 11 million gallons per day of treated wastewater to the Geysers for injection into the steam fields. This amount is a little less than half the flow the treatment system is expected to produce at build out. The project is intended to eliminate weather related problems of the city's disposal system and minimize treated wastewater discharges into the Russian River.

The city of Fort Bragg experienced water shortages during drought years. The water sources for the city are direct diversions from surface water sources. Supplies are inadequate to meet the city's needs during drought years and to maintain instream flows required by DFG. DHS issued an order in 1991 prohibiting new demands on the water system until adequate water supplies were developed. The city has been investigating alternative sources of supply and has implemented water conservation measures and improved existing system capacity. As a result of these corrective measures DHS lifted its order in 1993 and allowed the city to begin issuing building permits, subject to restrictions including no net increase in consumption and implementation of a conservation and retrofit program.

The city of Arcata has robust programs for achieving the dual goals of flood control and habitat enhancement. The city is committed to restoring the natural functioning of urban streams and wetlands. There are numerous city plans that direct the city to pursue the acquisition of conservation easements, deeds to wetland and other land for the re-establishment of a natural flood plain for storm water management and flood control and the restoration of fish and wildlife habitat on Arcata's five urban streams. Within the last ten years, the city has expended millions of dollars towards these ends. Along with city funding there are grants from the California Department of Water Resources, the California Department of Fish and Game, the Wildlife Conservation Board, and the U. S. Fish and Wildlife Service. The city has also collaborated with other government agencies, non-profit organizations, community groups and schools.

The Russian River Action Plan, prepared by Sonoma County Water Agency in 1997, provides a regional assessment of needs in the watershed and identifies fishery habitat restoration projects in need of funding. The SWRCB is promoting a coordinated Russian River fishery restoration plan. In 1997, NMFS listed steelhead trout as threatened and 2002 listed Coho salmon as endangered along part of the Central California coast that includes the Russian River Basin. SCWA, USACE, and NMFS signed an agreement to establish a framework for consultation under Section 7 of the Endangered Species Act. Under the agreement USACE and SCWA will jointly review information on their respective Russian River activities to determine effects to critical habitat. The Eel-Russian River Commission, composed of county supervisors from Humboldt, Mendocino, and Sonoma Counties (Lake County just left the Commission), provides a regional forum for agencies and groups to stay informed about projects and issues affecting the Eel and Russian Rivers.

Relationship with Other Regions

The region receives roughly X AF of imported water from the Sacramento River Region and flow from Oregon. The region exports about 800,000 acre-feet annually to the Sacramento River Region.

Looking to the Future

It is possible that expansion of local water sources will generally be adequate to meet the region’s expected municipal and industrial demands over the next 30 years. The Humboldt Bay Municipal Water District system may ultimately expand to serve the Trinidad-Moonstone area which is experiencing local water deficiencies. The Eureka-Arcata area is facing possible construction of a regional water treatment plant and is investigating groundwater development as an alternative source, which would not require treatment.

Crescent City has an adequate supply from the Smith River but needs to increase system transmission and storage capacity and may also be facing construction of a water treatment facility. The city of Rio Dell may also be facing construction of a surface water treatment facility. Ranney wells will be installed in the Eel River as a primary water supply for Rio Dell. Trinity County Waterworks District No. 1, which serves the town of Hayfork from the 800-AF Ewing Reservoir, has plans to enlarge the reservoir and expand its surface water system.

To address the need for greater certainty in project operations, USBR began preparing a long-term Klamath Project operations plan in 1995, but difficult and complex issues have delayed completion of the long-term plan. USBR has issued an annual operations plan each year since 1995 as it continues the development of a long-term plan. The Klamath River Compact Commission is facilitating discussions on management of interstate water resources and plans to promote intergovernmental cooperation on water allocation issues. A few additional wells are expected to augment irrigation supplies in the Butte Valley -- Tule Lake area. Pressure for additional groundwater development in areas like Scott and Shasta Valleys will be greater since the 2002 listing of the Coho salmon. The new listing, along with stricter applications of DFG code regulations will reduce the supplies available for irrigation from existing water developments and from natural runoff.

Regional Planning

Sonoma County WA is preparing an EIR to develop additional water supply as well as to expand its existing water transmission system. The project will be implemented under an agreement among SCWA and its water contractors. Components of the project include water conservation, increased use of the Russian River Project, and expansion and revised operation of the water transmission system. Water conservation is planned to provide additional saving of 6,600 acre-feet. The Russian River part will allow for increasing diversions from 75,000 to 101,000 acre-feet from the Russian River. This increase use of the Russian River Project water will require construction of additional diversion and conveyance facilities, including new diversion locations. The project will continue to meet existing instream flow requirements associated with the SWRCB's decision 1610 and will require new water rights applications to SWRCB. The transmission system component has two elements – facilities to divert and treat Russian River Project water and transmission system improvements allowing for delivery of up to 167,000 acre-feet per year. The final EIR was scheduled for late 1998.

The Mendocino Community Services District investigated new water supply sources, including wells in the Big River aquifer and desalting. To date, no acceptable water source has been identified. In 1990, town residents approved developing a public water system if an adequate water source could be found. The district is collecting hydrogeological data on the groundwater basin.

Water from Humboldt Bay Municipal Water District's Ranney collectors in the Mad River has been defined as groundwater under the influence of surface water and must be filtered. A regional filtration plant is estimated to cost $16 million. Accordingly, HBMWD is considering the feasibility of developing groundwater to replace a portion of the Mad River supply and to provide for needed future supplies. In the early 1990s, about 45 MGD of the District's 56 MGD average water use was supplied to the Eureka pulp mills for industrial purposes. This water did not require treatment. Today, if the district turns to the supply that recently was dedicated to the mills, this reallocation of HBMWD supplies will have to be treated, if applied to domestic use.

The Eel-Russian River Commission is exploring possibilities for maintaining or augmenting available water supplies, including construction of additional storage on the upper Eel River and conjunctive use of groundwater with existing surface supplies.

Most Northern California counties lack the resources and funding to assist them with regional or local plans. With continued budget constraints and limited resources, requests for more detailed information, necessary for resolving county, regional and state water issues and concerns will more than likely increase. DWR could assist in providing the needed data and analysis for locals and regional planning.

Water Portfolios for Water Years 1998, 2000 and 2001

The following tables present actual information about the water supplies and uses for the North Coast hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 150 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents normal hydrologic conditions with annual precipitation at 100 percent of average for the North Coast region, and year 2001 reflected dryer water year conditions with annual precipitation at 60 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 2-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables (Table 2-2) and companion Water Portfolio flow diagrams (Figures 2-2, 2-3 and 2-4) provided more detailed information about how the available water supplies are distributed and used throughout this region.

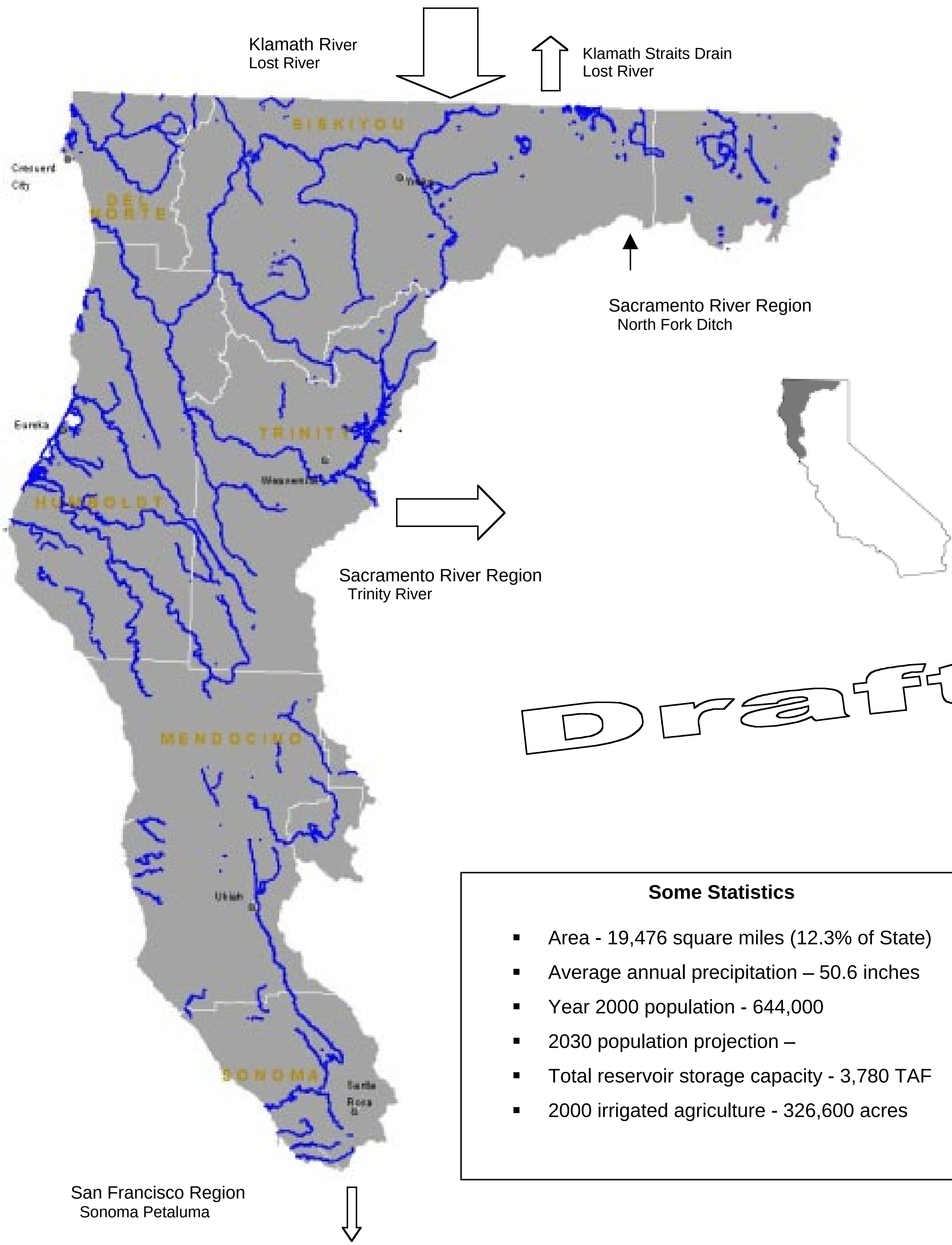
A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table (Table 2-3). Because most of the North

Coast region is largely undeveloped, dedicated environmental water uses are a larger component of the total developed water uses in this region. Table 2-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- Del Norte, Mendocino, and Siskiyou Counties
- Mendocino County Russian River Flood Control and Water Conservation Improvement District

Figure 2-1
North Coast Hydrologic Region



Some Statistics

- Area - 19,476 square miles (12.3% of State)
- Average annual precipitation – 50.6 inches
- Year 2000 population - 644,000
- 2030 population projection –
- Total reservoir storage capacity - 3,780 TAF
- 2000 irrigated agriculture - 326,600 acres

Table 2-1
North Coast Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	79,216	50,755	31,254
Inflow from Oregon	1,323	1,397	1,226
Inflow from Colorado River	0	0	0
Imports from Other Regions	2	2	2
Total	**80,541**	**52,174**	**32,482**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	628	796	664
Outflow to Oregon	109	114	66
Exports to Other Regions	681	669	669
Statutory Required Outflow to Salt Sink	34,715	18,763	8,021
Additional Outflow to Salt Sink	110	120	124
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	43,642	31,986	23,586
Total	**79,885**	**52,448**	**33,130**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	703	-246	-491
Change in Groundwater Storage **	-47	-28	-157
Total	**656**	**-274**	**-648**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	1,153	1,354	1,037

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 2-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	North Coast 1998 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	North Coast 2000 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	North Coast 2001 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		1,322.5				1,396.7				1,226.2			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	79,216.3				50,755.1				31,254.4				REGION
6a	Runoff - Natural	53,812.0				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		375.4				592.4				351.1			PSA/DAU
10	Local Imports		2.0				3.1				16.4			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		334.5				408.7				238.2			PSA/DAU
13	State Water Project Deliveries		-				-				-			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		1,445.3				1,444.5				1,473.5			REGION
16	Environmental Water Account Releases		N/A				N/A				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		5.3				6.4				4.9			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		11.7				11.7				11.7			PSA/DAU
b	Recycled Water - Urban		0.3				0.3				0.4			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		12.5				6.9				6.9			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		4.0				3.6				3.5			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		52.6				61.2				72.2			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		1.2				1.3				0.7			PSA/DAU
c	Deep Percolation of Applied Water - Urban		14.6				19.4				18.6			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		67.5				86.1				23.5			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		143.5				115.5				30.3			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	2,236.3				2,740.7				2,495.0				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	221.1				335.4				462.7				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	2,938.8				2,495.0				2,003.9				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				38.9				45.2				42.4	REGION
b	Evaporation from Reservoirs				167.5				181.3				162.7	REGION
36	Ag Effective Precipitation on Irrigated Lands		215.7				129.0				122.7			REGION
37	Agricultural Use		633.1	513.0	500.5		785.3	638.0	631.2		633.4	537.7	530.8	PSA/DAU
38	Wetlands Use		391.4	267.1	267.1		424.4	310.2	310.2		254.3	223.3	223.3	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		42.4				30.7				30.3			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		19.8				40.0				42.1			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		10.9				13.8				15.0			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		2.7				3.1				3.7			PSA/DAU
40	Urban Commercial Use		20.8				16.0				17.3			PSA/DAU
41	Urban Industrial Use		26.8				27.6				27.7			PSA/DAU
42	Urban Large Landscape		4.8				12.8				13.5			PSA/DAU
43	Urban Energy Production		-				-				0.1			PSA/DAU
44	Instream Flow		1,445.3	1,424.9	1,424.9		1,444.5	1,441.9	1,441.9		1,473.5	1,473.5	1,473.5	PSA/DAU
45	Required Delta Outflow		-	-	-			-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		33,290.1	33,290.1	33,290.1		17,321.1	17,321.1	17,321.1		6,547.6	6,547.6	6,547.6	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				449.8				557.8				460.6	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				155.7				194.4				155.3	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				22.1				44.2				48.3	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				2.5				0.2				0.2	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				29.6				33.5				26.4	PSA/DAU
50	Urban Waste Water Produced	87.9				75.6				77.7				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				-				-				-	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				6.9				7.1				4.2	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				0.4				0.4				0.1	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				23.1				41.9				43.8	PSA/DAU
b	Return Flows to Salt Sink - Urban				85.0				76.5				79.1	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				1.7				1.7				1.5	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				34,715.0				18,763.0				8,021.1	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				109.3				113.7				66.4	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	2.0				2.0				2.0				REGION
56	Regional Exports	680.5				668.5				668.5				REGION
59	Groundwater Net Change in Storage	-46.9				-28.4				-156.8				REGION
60	Surface Water Net Change in Storage	702.5				-245.7				-491.1				REGION
61	Surface Water Total Available Storage	3,779.9				3,779.9				3,779.9				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 2-3
North Coast Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	4.8			12.8			13.5		
Commercial	20.8			16.0			17.3		
Industrial	26.8			27.6			27.7		
Energy Production	0.0			0.0			0.1		
Residential - Interior	53.3			44.5			45.3		
Residential - Exterior	22.5			43.1			45.8		
Evapotranspiration of Applied Water		22.1	22.1		44.2	44.2		48.3	48.3
Irrecoverable Losses		2.5	2.5		0.2	0.2		0.2	0.2
Outflow		85.0	85.0		76.5	76.5		79.1	79.1
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**128.2**	**109.6**	**109.6**	**144.0**	**120.9**	**120.9**	**149.7**	**127.6**	**127.6**
Agriculture									
On-Farm Applied Water	633.1			785.3			633.4		
Evapotranspiration of Applied Water		449.8	449.8		557.8	557.8		460.6	460.6
Irrecoverable Losses		29.6	29.6		33.5	33.5		26.4	26.4
Outflow		33.6	21.1		46.8	39.9		50.7	43.8
Conveyance Losses - Applied Water	24.0			27.5			17.9		
Conveyance Losses - Evaporation		6.9	6.9		7.1	7.1		4.2	4.2
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		2.0	2.0		2.0	2.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**657.1**	**521.9**	**509.4**	**812.8**	**647.2**	**640.3**	**651.3**	**541.9**	**535.0**
Environmental									
Instream									
Applied Water	1,445.3			1,444.5			1,473.5		
Outflow		1,424.9	1,424.9		1,441.9	1,441.9		1,473.5	1,473.5
Wild & Scenic									
Applied Water	33,290.1			17,321.1			6,547.6		
Outflow		33,290.1	33,290.1		17,321.1	17,321.1		6,547.6	6,547.6
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	391.4			424.4			254.3		
Evapotranspiration of Applied Water		155.7	155.7		194.4	194.4		155.3	155.3
Irrecoverable Losses		0.4	0.4		0.4	0.4		0.1	0.1
Outflow		111.0	111.0		115.4	115.4		67.9	67.9
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	391.4	267.1	267.1	424.4	310.2	310.2	254.3	223.3	223.3
Total Environmental Use	**35,126.8**	**34,982.1**	**34,982.1**	**19,190.0**	**19,073.2**	**19,073.2**	**8,275.4**	**8,244.4**	**8,244.4**
TOTAL USE AND LOSSES	**35,912.1**	**35,613.6**	**35,601.1**	**20,146.8**	**19,841.3**	**19,834.4**	**9,076.4**	**8,913.9**	**8,907.0**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	375.4	375.4	368.8	592.4	592.4	588.3	351.1	351.1	347.1
Local Imported Deliveries	2.0	2.0	2.0	3.1	3.1	3.1	16.4	16.4	16.2
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	334.5	334.5	328.6	408.7	408.7	405.9	238.2	238.2	235.5
SWP Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Required Environmental Instream Flow	34,746.8	34,746.8	34,746.8	18,583.6	18,583.6	18,583.6	7,933.7	7,933.7	7,933.7
Groundwater									
Net Withdrawal	142.9	142.9	142.9	241.5	241.5	241.5	362.4	362.4	362.4
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	78.2			93.9			100.3		
Reuse/Recycle									
Reuse Surface Water	220.3			211.6			62.2		
Recycled Water	12.0	12.0	12.0	12.0	12.0	12.0	12.1	12.1	12.1
TOTAL SUPPLIES	**35,912.1**	**35,613.6**	**35,601.1**	**20,146.8**	**19,841.3**	**19,834.4**	**9,076.4**	**8,913.9**	**8,907.0**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 2-2
North Coast Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

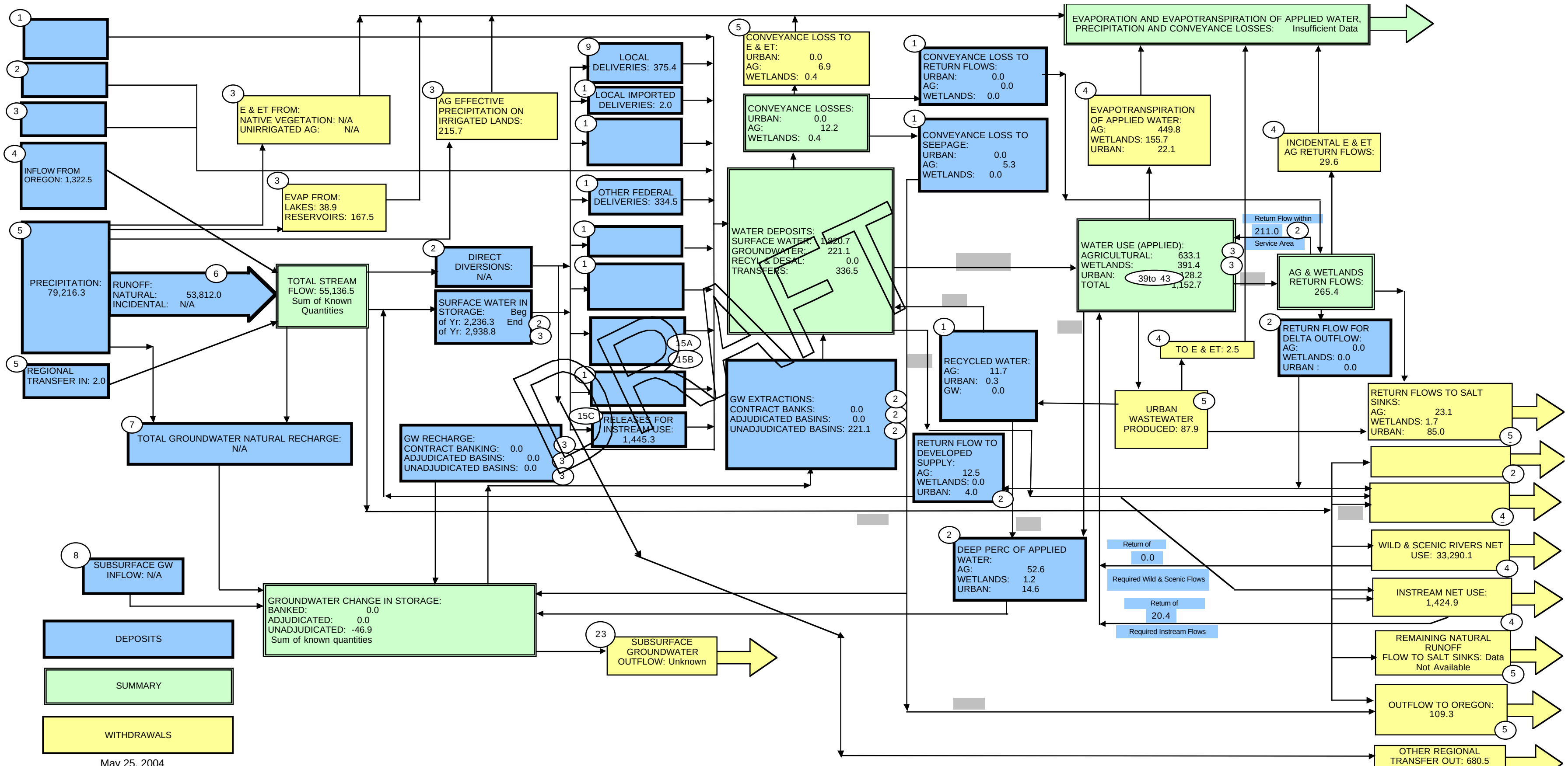


Figure 2-3
North Coast Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

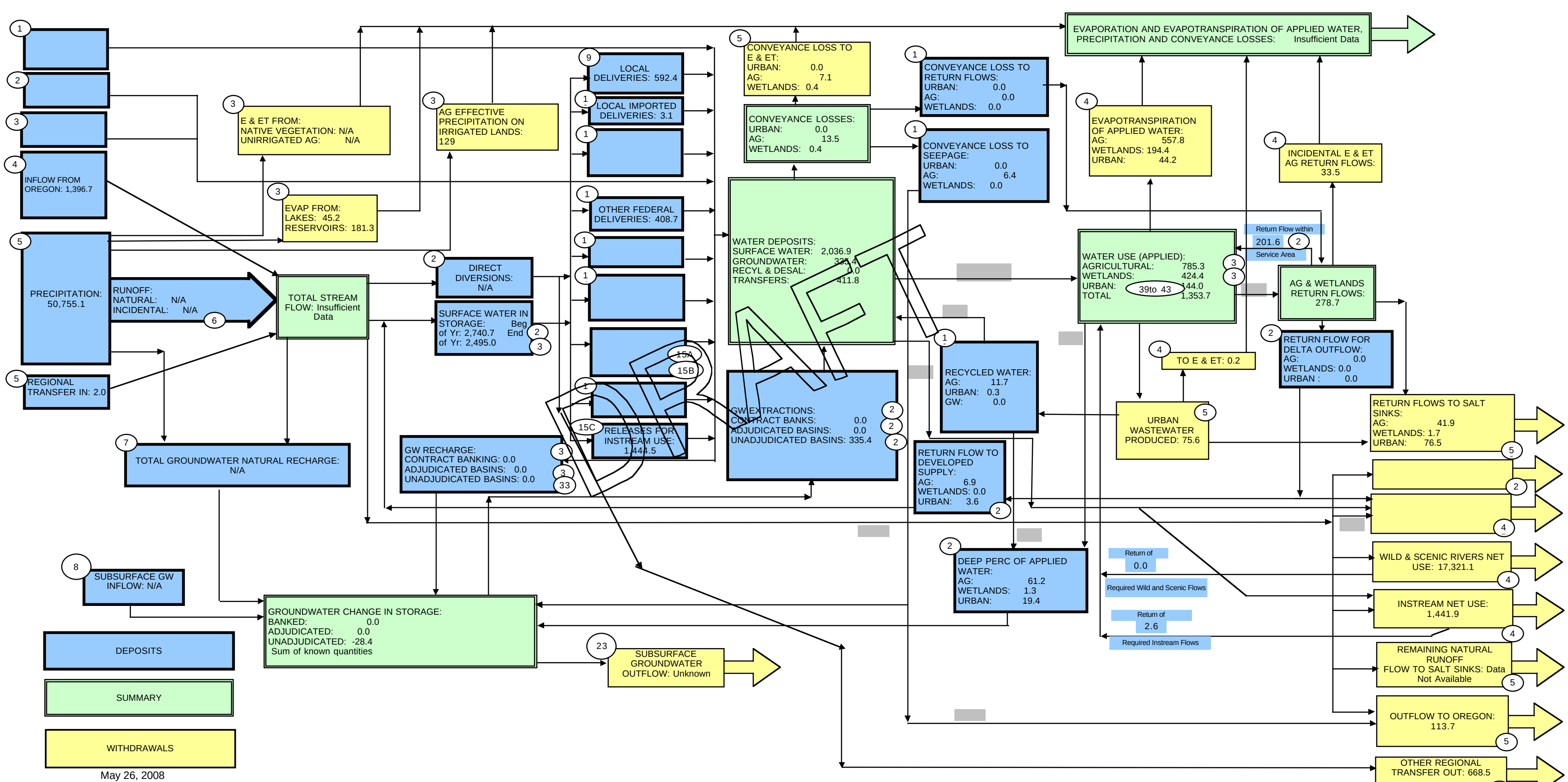
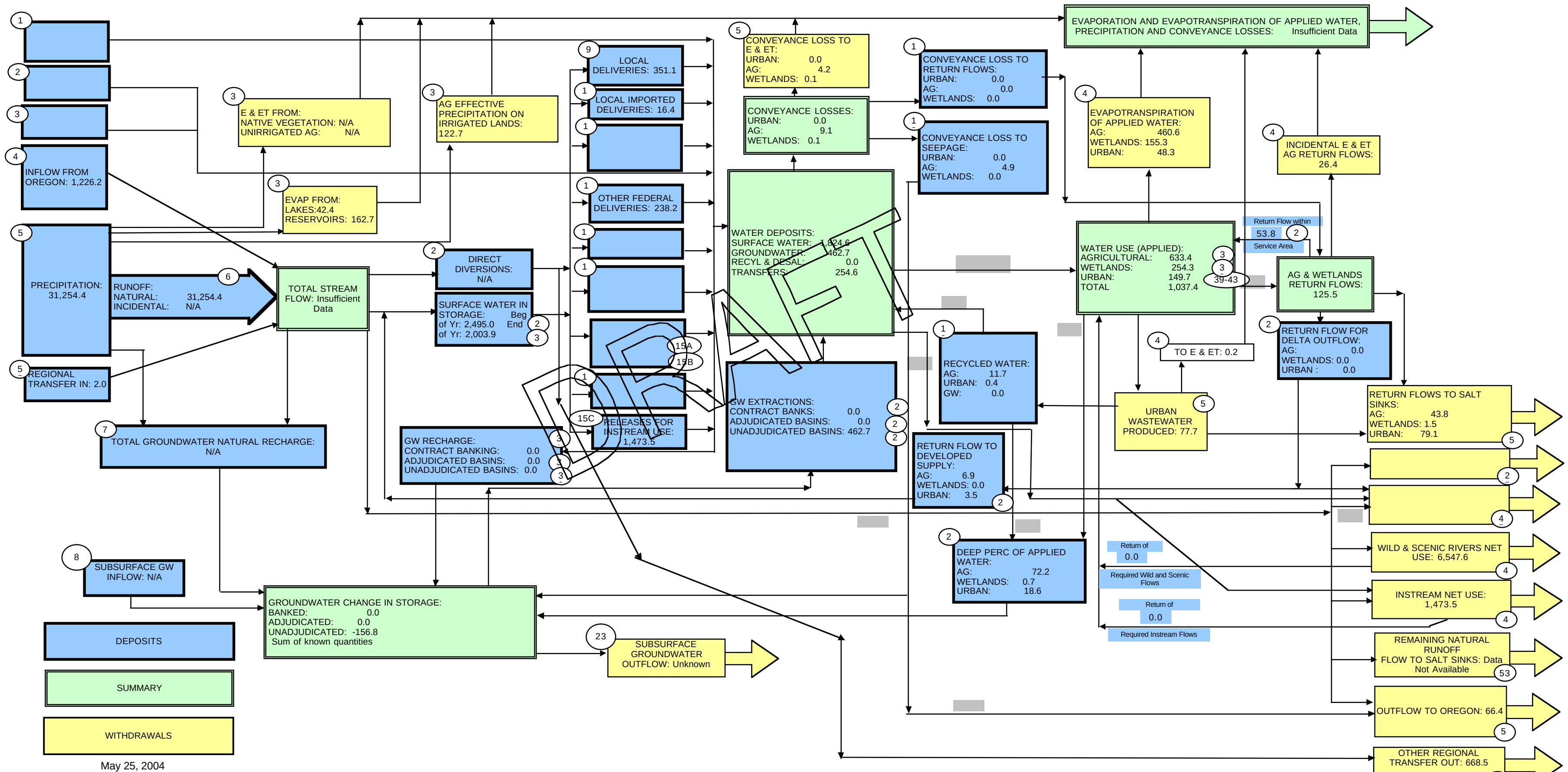


Figure 2-4
North Coast Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 3. San Francisco Bay Hydrologic Region

Setting

Topography, Hydrology and Climate

The San Francisco Bay Hydrologic Region, which occupies parts of nine counties, extends from southern Santa Clara County north to Tomales Bay in Marin County, and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville. The eastern boundary follows the crest of the Coast Range, the highest peaks of which are more than 3,000 feet above sea level. Streams in the region flow into the Bay-Estuary or to the Pacific Ocean. The climate within the region varies significantly from west to east. Coastal areas are typically cool and often foggy and inland valleys are warmer, with a Mediterranean-like climate. Rainfall amounts vary among sub-regions and can be highly influenced by vegetative cover and marine influences. The region does not have a lot of natural lakes or built reservoirs and relies chiefly on water storage in adjacent and remote counties for its stored supplies.

Land Use

Portions of the region are highly urbanized and include the San Francisco, Oakland, and San Jose metropolitan areas. Agricultural acreage occurs mostly in the north and northeast in Napa, Marin, Sonoma, and Solano counties. Santa Clara and Alameda counties also have significant agricultural acreage at the edge of the urban development. The predominant crops are grapes along with fruit and nut trees, hay production, and dairy and livestock operations. In the area along the ocean coastline south of the Golden Gate, more than half of the irrigated acres are in high value specialty crops, such as artichokes, strawberries or flowers.

The Bay Region boasts significant Pacific Coast marshes such as Pescadero marsh and Tomales Bay marshes as well as San Francisco Bay itself. San Francisco Bay is an estuary with a deep central channel, broad mudflats and fringing marsh. The Bay is commonly divided in to the South, Central, and North Bay. The North Bay is more brackish while the South and Central bays are more marine dominated. Suisun Marsh in between the North Bay and the Delta is the largest contiguous brackish water marsh remaining on the west coast of North America, providing more than 10 percent of California's remaining wetlands. The combined flows of the Sacramento and San Joaquin watersheds flow through the Delta and into the Bay. Delta outflow interacts with tides to determine how far salt water intrudes from the ocean into the San Francisco Bay Estuary. The resulting salinity gradients influence the distribution of many estuarine fishes and invertebrates as well as plants, birds, and animals in wetlands areas. Delta outflow varies with hydrology, reservoir releases, and diversions upstream.

Population and Water Use

The Bay Region is a heavily urbanized region. The Association of Bay Area Governments projects that even with the implementation of “Smart Growth” policies by local government, the nine counties that include the Bay Region will add 2 million people, 750,000 households and create 1.5 million jobs by 2030. Water use in the Bay Region is predominantly urban with over 50 percent of the use being residential. There are also numerous industrial users around the Bay. Agricultural use is a smaller percentage of total water use in this region than in the Sacramento, San Joaquin, and Delta. For example, in the Santa Clara Valley Water District service area, agricultural use is 29,200 AF out of total water use of 383,300 AF/Yr, which is less than 10 percent.

Water Supplies

In the early 1900s, local water agencies developed significant imported water supplies from the Mokelumne and Tuolumne Rivers to meet the anticipated demands. At the same period of time, local reservoirs and watersheds were being developed to capture surface supplies, to recharge the groundwater basins and to act as terminal reservoirs for the larger projects. Later, state and federal water projects brought water to the northern, eastern, and southern parts of the region through a number of canals.

The following table shows the sources of imported water for the area:

Water Conveyance Facility	Water source	Operator	Counties Served	Water supplied to the Bay Region via facility in 2000
Hetch Hetchy Aqueduct	Tuolumne River	SFPUC	San Francisco, San Mateo, Alameda, and Santa Clara counties	32%
Mokelumne Aqueduct	Mokelumne River	EBMUD	Alameda, Contra Costa counties	25%
South Bay Aqueduct	Delta	DWR (SWP)	Alameda, Contra Costa, Santa Clara counties	15%
San Felipe Unit	Delta via San Luis Reservoir	USBR (CVP)	Santa Clara County	8%
Contra Costa Canal	Western Delta	CCWD/CVP	Contra Costa County	7%
North Bay Aqueduct	Northern Delta	DWR (SWP)	Solano, Napa counties	4%
Putah South Canal	Lake Berryessa	USBR	Solano County	4%
Sonoma Petaluma Aqueduct	Russian River	SCWA	Sonoma County	4%

Groundwater

Local groundwater accounts for only about five percent of the region's average water year supply. The more heavily used basins include the Santa Clara Valley, Livermore Valley, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley Groundwater Basins. Groundwater resources continue to be investigated and developed in some areas of the Bay Region.

Recycled Water

Recycled water in the Bay Region is used in a full spectrum of applications, including landscape irrigation, industrial cooling, agricultural needs and as a supply to the areas many wetlands.

Role of Conservation

Urban water districts in the Bay Region generally are signatories to the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU) that commits them to make a good faith effort to implement Best Management Practices (BMPs). In 2001, the California Urban Water Agencies issued a report that projected net water savings for the Bay Region based on implementation of the MOU at about 105,000 acre-feet. These numbers are being updated and revised by the CALFED Bay-Delta Water Use Efficiency Program as part of their planning process.

The six agencies that participate in the Bay Area Water Agencies Coalition, SFPUC, SCVWD, CCWD, EBMUD, ACWD, and Zone 7, recently completed a study on conservation advancement that showed that as a whole, their members had reduced the per capita water use by 16 percent since 1986 and decreased total water use by 1.4 percent despite a 17 percent increase in population served during the same time period. Individual agency results varied around these numbers.

Drinking Water Quality

The quality of San Francisco Bay Region drinking water supplies varies by source. The source water quality of San Francisco Public Utility Commission's Hetch Hetchy supply, East Bay Municipal Utility District's Mokelumne River supply, and local surface and groundwater supplies is generally higher than that of water diverted from the Delta.

Users that rely on Sierra sources are generally interested in protecting their existing water quality. Urban districts that depend on the Delta for part of their drinking water all meet current drinking water standards but remain concerned about issues such as salinity and about the cost to meet future water quality standards because of the risk of degradation of Delta water quality and increasingly stringent drinking water quality standards. About a third of the water brought into the Bay region comes from the Delta.

Environmental Water Quality:

The Bay Region receives contaminants from point and non-point sources in the highly urbanized watershed, as well as inputs from Napa, Petaluma and Guadalupe Rivers and the Sacramento San Joaquin Delta. The Bay acts as a sediment repository, so persistent sediment-bound contaminants, such as mercury, dioxins, PCBs, and organochlorine pesticides have accumulated over time throughout the Bay. These compounds bioaccumulate in the food chain, causing high levels of contaminants in fish that may also affect consumers of bay fish, including humans and wildlife. Water quality can also be affected by shorter-term exposures to metals, pesticides, and other toxic compounds that can be in the river inputs or associated with runoff in the bay watershed. Other water quality concerns include copper and nickel in the South Bay, selenium from Contra Costa refineries, erosion from vineyards in Napa and Sonoma Valleys, pesticides in urban creeks generally, and toxicity of water and especially sediment.

Because the Bay has several active marine ports, another water quality issue is discharge of ballast water and vessel wastes. In addition there is a need for maintenance dredging and disposal of contaminated sediments.

Outside of the San Francisco Bay Estuary, Tomales Bay is one of only four commercial shellfish growing areas on the entire west coast. Some of the coastal watersheds of Marin and San Mateo counties provide important habitat for listed species of coho salmon and steelhead. Sediment threatens water quality (need to identify source of sediment?) and habitat in Bolinas Lagoon, the only wetland on the West Coast designated as a Wetland of International Significance by USFWS.

Wetlands and Watershed Management

The San Francisco Bay is one of the most modified estuaries in the United States. The topography, ebb and flow of the tides, patterns of freshwater inflows locally and from the Delta, and the availability and types of sediment have all been altered. Many new species of plants and animals have been introduced. These exotic and invasive species, such as the Chinese mitten crab and Asian clam, threaten to undermine the estuary's food web and alter its ecosystem. Water quality has also changed over time. The character of the wetlands around the Bay has changed dramatically. Over 75 percent of the Bay's historical wetlands have been lost or altered through a variety of land use changes around the bay including filling for urban and industrial uses and diking for agricultural uses. There used to be 190,000 acres of tidal marsh, now there are 40,000 acres with only 16,000 of these having been tidal marsh historically. Tidal flats have been reduced from 50,000 acres to 29,000 acres due to bay fill, erosion, tidal marsh evolution, and other factors. The total area covered by the Bay at high tide was historically about 516,000 acres. Now the Bay covers about 327,000 acres at high tide. There are about 500 species of fish and wildlife associated with the baylands, twenty of which are now threatened or endangered. In recent decades, filling of the Bay has slowed significantly due to regulatory changes and the creation of the Bay Conservation and Development Commission, a state agency charged with permitting activities along the shore of the Bay.

State of the Region

Some of the major water related challenges facing the Bay Region include improving water supply reliability to sustain water supplies in drought periods and other emergency outages, maintaining and improving drinking water quality across the region by continuing to meet and exceed current and anticipated drinking water quality standards and protecting drinking water sources, and improving the ecosystem health of San Francisco Bay. Other challenges include linking local land use planning with water system planning and improving water management planning on a regional level.

Many projects and programs are already underway to address these needs. However, the various parties concerned with water related issues in the Bay Region are increasingly recognizing that there is also a need to develop solutions on a more collaborative regional or sub-regional basis. Some of the long-standing regional planning efforts within the Bay Region that address ecosystem restoration issues are described in this section. Some of the emerging water management and drinking water quality regional planning initiatives are described in the next section, "Looking to the Future."

Water Supply Reliability

Generally, Bay Region water districts have sufficient supplies to meet the needs of their customers in normal water years now and for some time into the future. The major water supply reliability challenges occur during droughts and other emergencies. Currently, during drought periods, locally developed water supplies are very limited and imported water supplies can be short of water users needs. This problem is expected to worsen over time as the region's urban use grows and because these imported supplies may be more at risk due to various other factors. For example, area of origin communities outside the San Francisco Bay Region will also need more water as they grow. Some are concerned that water could be reallocated for environmental needs or changes in Delta outflow and operational requirements could also affect the San Francisco Bay Regions' imported water supply.

Some examples of future shortfall estimates are:

- Santa Clara Valley Water District's (SCVWMD) 2001 Urban Water Management Plan shows a supply shortfall in a repeat of the most severe single dry year in 2020 of over 250,000 AF or 60 percent of the projected demand.
- East Bay Municipal Utility District (EBMUD), without the Freeport Project, faces customer rationing at 68 percent in 2020. With Freeport, rationing would be reduced to 25 percent during anticipated dry periods.

The exact magnitude of drought year shortfalls and the best water management tools to be used to address them are, not surprisingly, controversial. Each district has different assumptions and policies that guide their planning. Different systems rely on water from different watersheds so even the definition of a drought for planning purposes varies somewhat. However, drought supply reliability will continue to be a major challenge for water supply planning in the Bay Region.

The Bay Region is also prone to major earthquakes and other natural disasters that could damage and interrupt water delivery. Critical seismic reliability upgrades are required for some facilities that cross or are located on any of the three active earthquake fault systems (i.e., San Andreas, Hayward, and Calaveras Faults). According to San Francisco Public Utilities Commission (SFPUC), a major earthquake could disrupt water supplies for up to 60 days in their system, which serves 2.4 million people in the Bay Region. In other areas, significant progress has already been made on seismic vulnerability but challenges remain.

Each water district has plans underway to address these drought shortfalls and to ensure that their systems will provide a certain level of water service in the event of an earthquake or natural disaster. Details such as future projected water demands, supplies, and planned capital expenditures can be found in each district's plans. However, there currently aren't statistics that summarize the current and future expenditures neither planned region-wide nor for the amount of water expected to be developed for droughts or the expected performance region wide in the event of a seismic event. This is the type of information that may become available through integrated resources planning.

Some examples of projects underway to address future reliability needs are described in the following sections. In addition to the example projects listed here, there are numerous other efforts underway.

Seismic Vulnerability and Drought Supply Planning

- SFPUC is currently implementing a $3.6 billion capital improvement program to replace or repair of aging facilities, provide seismic upgrades and improve water supply reliability.
- EBMUD is near completion of a 10-year seismic improvement program (SIP). The SIP is a $189 million program to improve post-earthquake firefighting capability and water service within the EBMUD service area.
- Zone 7 is updating its Well Master Plan so that it can more readily rely on groundwater to meet its normal demands if a seismic event disrupts the imported water delivery system.
- SCVWD is implementing and updating its integrated water resources plan to address water supply shortfalls and preparing a comprehensive water utility infrastructure management program to address seismic and security hazards.
- CCWD recently completed the major components of its $120 million Seismic Reliability Improvements program, including a 21 mile Multi-purpose Pipeline, a new pumping plant at its Mallard Slough Intake, interties and seismic valves. These facilities improve reliability and fire-fighting flows after a major earthquake.

Groundwater

South Bay Aqueduct contractors have entered into agreements with groundwater banks outside the region to make water available in droughts and have implemented local conjunctive use programs. The Bay-Delta Program has invested $2.4 million in eight local groundwater projects in areas like Santa Clara County.

Conveyance and Interconnections

- East Bay Municipal Utilities District, in conjunction with the Sacramento County Water Agency, is currently preparing preliminary design documents to divert water from the Sacramento River to reduce customer rationing during multi-year droughts.
- A 40 mgd intertie between the SCVWD system and the SFPUC system was completed recently. EBMUD and SFPUC are also expecting to begin construction on a 40 mgd intertie between their systems shortly.
- Studies are underway on the San Luis Low Point Improvement Project (SLLPIP) to address water quality and conveyance issues for South Bay water users and to improve the reliability of water supplies from San Luis Reservoir for the customers of the San Felipe Unit of the Central Valley Project including SCVWD. Additional details on the SLLPIP including schedule and budget can be found in the CALFED Bay-Delta Program Plan for the Conveyance Program.

Water Conservation and Recycling

Many different wastewater reclamation/recycling projects are underway or in study and environmental documentation stages. The Bay Area Regional Water Recycling Program (BARWRP) Water Recycling Project Master Plan, prepared in 1999, analyzed recycling for the counties of San Francisco, San Mateo, Santa Clara, Alameda and Contra Costa and developed a plan to achieve 125,000 AF/yr of water recycling over the next 10 years.

BARWRP also had a number of recommendations to make reclamation and recycling more implementable on a regional basis including increasing public acceptance and dealing with environmental impacts regionally. Many of the near term recycling project identified in the plan are now being developed, some with $43 million in Bay-Delta program funding. BARWRP members are reviewing overall progress and these recommendations and updating the program. A similar coordinated recycling program is underway in the North Bay.

Water conservation is generally included in each agencies planning and the CALFED Bay-Delta Program has invested over $15 million in 35 local water conservation programs.

Surface Storage

Water agencies are also studying several surface storage projects within the region and in other regions to help with drought relief, emergency storage, and water quality management. Some of the surface water storage projects under consideration in the region include expansion of Calaveras, Pacheco, and Los Vaqueros reservoirs. Calaveras Reservoir is being studies as part of the SFPUC Capitol Improvement Plan to provide water supply reliability to SFPUC customers. Los Vaqueros expansion is being evaluated as part of the CALFED Program. This project is being studied both as a way to improve drought supply reliability and water quality for the Bay Region. Studies of the potential for expansion of Los Vaqueros are underway. Additional details on the schedule and budget for this project can be found in the CALFED Bay-Delta Program Plan for Storage. Expansion of Pacheco Reservoir is being considered by CALFED as an alternative under the SLLPIP. Additional information on this project can be found in the CALFED Bay-Delta Program Plan for Conveyance.

Desalination

With recent advances in technology, several water agencies in the Bay Region are investigating desalinization as a source to improve water supply reliability. Marin Municipal Water District is proposing a major new desalination project for Marin County using water from San Rafael Bay. EBMUD, CCWD, SCVWD and SFPUC are conducting a joint feasibility study for a desalinization plant to serve the Bay Region as an emergency or dry-year supply. Alameda County Water District has built a brackish water desalination plant to produce potable water from brackish water taken from local aquifers.

Drinking Water Quality

Water users that rely on Sierra sources are generally interested in protecting their existing high water quality. There are some particular issues such as SFPUC's Hetch Hetchy supplies are unfiltered and use a disinfection strategy that can result in high levels of disinfection by-products.

Most districts that deliver water from the Delta are pursuing a range of projects to protect and improve the quality of the water that they serve. These projects include increased ability to store water when quality is good, source control, and improved treatment of drinking water supplies.

The storage of higher quality Delta water in Los Vaqueros Reservoir completed in 1998, as well as implementation of advanced water treatment, has significantly improved the water quality in the service area of the Contra Costa Water District. CCWD is continuing to work with local and regional agencies and CALFED to improve source water quality. Examples include CALFED funded projects to relocate agricultural drains and line some of the unlined portions of the Contra Costa Canal that are impacted by local groundwater.

Utilities in Solano County utilize a blend of local surface water and Delta water of variable quality delivered via the North Bay Aqueduct. The Bay-Delta program, working with Solano County, is improving watershed management near the intake for the NBA and evaluating intake relocation.

Santa Clara Valley Water District, Alameda County Water District, and Zone 7 Water Agency employ a diversified portfolio of Delta water, local surface water, and groundwater coupled with advanced treatment to meet water quality standards.

The CALFED Bay-Delta Program has funded several efforts to improve water quality in the region including the evaluation of the proposed expansion of Los Vaqueros Reservoir previously discussed under "Storage", the SLLPIP discussed under "Conveyance", and the Bay Area Water Quality and Supply Reliability program which is evaluating a broad array of cooperative regional projects to benefit ACWD, Zone 7, SFPUC, BAWSCA, CCWD, SCVWD, and EBMUD. Some of the regional project concepts being considered in this study include the expansion of storage in Calaveras and Los Vaqueros reservoirs, additional recycling, additional conservation beyond existing BMPs, and desalination. Details on schedule and budget for the BAWQWSRP can be found in the CALFED Bay-Delta Program Plan for the Drinking Water Quality Program.

In general, groundwater quality throughout most of the region is suitable for most urban and agricultural uses with only local impairments, such as leaking underground storage tanks. Groundwater in the Livermore Valley and Niles Cone (southern Alameda County) basins has high levels of total dissolved solids, chloride, boron, and hardness; both Zone 7 and ACWD are implementing wellhead demineralization projects to improve groundwater basin and delivered water quality. Meanwhile, parts of the basin underlying the Santa Clara Valley are threatened by pollutants from various industrial activities and historic agriculture. Elsewhere, groundwater in Petaluma Valley and the Gilroy-Hollister Valley has high levels of nitrate impacting domestic use of wells. Recharge projects and use of imported water has successfully stopped or reversed seawater intrusion into aquifers around the Bay.

Environmental Water Quality:

Water and sediment of the Estuary meet cleanliness guidelines for most contaminants, with constituents in water meeting toxicity and chemical guidelines about 87 percent of the time. Sediment concentrations were more problematic due to the legacy pollutants – only about 60 percent of the sediment samples met chemical guidelines and passed toxicity tests. Over the long term, water quality has shown significant improvement with less toxic episodes, decreased silver concentrations in the south bay and improved oxygen levels. These improvements are largely due to improved wastewater treatment methods, and reductions in the use of organophosphate pesticides, and other contaminant control strategies. On the other hand, new contaminants are emerging that may be causing impacts to the aquatic ecosystem, including PBDEs (polybrominated Diphenyl Ethers), pyrethroid insecticides, and chemicals from pharmaceuticals and personal care products.

Actions have begun to control new inputs of the persistent sediment contaminants in the bay. Most organochlorine pesticides and PCBs have been banned from use, and the concentrations in the sediments and in organisms appear to be declining. The San Francisco Regional Water Quality Control Board is developing TMDLs (Total Daily Maximum Loads) to address the mercury sources to the bay, which include the New Almaden mine, as well as mercury loads from the Sacramento-San Joaquin delta related to the thousands of abandoned mercury and gold mines in the central valley watershed. Mercury contamination in bay fish, such as the striped bass has remained high for more than 30 years. There is also concern that wetland restoration around the bay could increase mercury methylation processes and cause higher contamination in the fish. The CALFED Bay Delta Program, and other organizations, have funded a number of studies to determine potential effects of restoration and explore management actions that would decrease methyl mercury production and bioaccumulation.

Since 1993, the San Francisco Regional Monitoring Program has been providing monitoring and synthesis of findings on water, sediment and fish contamination issues in the bay. The annual conference and publication “Pulse of the Estuary” is produced by the San Francisco Estuary Institute and summarizes the state of what is known about the bay’s water quality issues. In addition to the mercury research mentioned previously, the CALFED Bay Delta Program has funded $10 million in projects related to water quality in the bay, including watershed management, pesticide use reduction, and toxicity studies.

Wetlands and Watershed Management

Although there are serious problems facing San Francisco Bay, its wetlands, and watershed, there has been a concerted effort over the last 20 years to restore the Bay. Some of the major planning and implementation efforts are described here. Expenditures to date on ecosystem restoration include $32 million in Bay-Delta Program funding, along with significant local, state and federal funding.

The Comprehensive Conservation and Management Plan completed by the San Francisco Estuary Project in 1993, presents a blueprint of 145 specific actions to restore and maintain the chemical, physical and biological integrity of the Bay and Delta. The CCMP has been implemented over time by a wide variety of local, state and federal partners including the CALFED Bay-Delta Program. The Estuary Project regularly updates the priorities for CCMP implementation and prepares a report on the State of the Estuary. In addition, the Estuary Project prepares Bay-Delta Report card that identifies many of the restoration projects underway to track progress implementing the CCMP. The most recent priorities identified by Estuary Project are:

- Reduce the impact of invasive species on the estuary through prevention, control, eradication, and education.
- Expand, restore, and protect Bay and Delta Wetlands and contiguous habitats. (These two priorities were both identified as top priorities)
- Protect and restore watersheds, including promoting creek restoration, throughout the Estuary.
- Create “incentives” that motivate governments, landowners, businesses and communities to protect and restore the Estuary.
- Minimize or eliminate pollution of the Estuary from all sources.
- Increase public interaction with the Estuary’s natural resources, encourage stewardship, and promote the values ecological processes provide to human activities and the effects of human activities on them.
- Continue, sustain, and expand the regional monitoring program to address all key CCMP issues including pollution, wetlands including mitigation measures, watersheds, dredging and sediment transport, biological resources, land use and flows and integrate scientific monitoring results into management and regulatory actions.
- Promulgate baseline inflow standards for San Francisco, San Pablo, and Suisun Bays to protect and restore the Estuary.

The Baylands Ecosystem Habitat Goals Report, prepared by the Habitat Goals Project in 1999 is a guide for restoring and improving the baylands and adjacent habitats of the San Francisco Estuary. It provides recommendations for the kinds, amounts, and distribution of wetlands and related habitats that are needed to sustain diverse and healthy communities of fish and wildlife resource in the Bay. The CCMP originally identified the need for these types of habitat goals. The recommendations are being implemented over time through voluntary restoration efforts that include many local, state and federal partners.

The Implementation Strategy for The San Francisco Bay Joint Venture, prepared in 2001 identified actions in the Habitat Goals Report that were consistent with the Joint Venture’s objectives. The state and federal partners in the Joint Venture are implementing these actions.

State, Federal, and local governments, landowners, and nonprofit agencies have been working cooperatively to restore the San Francisco Bay estuary for a number of years in conjunction with these and other planning processes. Because the restoration and watershed management projects around the Bay are so numerous, each one is not listed individually. Additional information can be found on websites for groups active in restoration such as the San Francisco Bay Joint Venture (www.sfbayjv.org), the Wetlands Regional Monitoring Program’s Wetlands Tracker (ww.wrmp.org) or the Estuary Project’s Report Card (www.abag.ca.gov/bayarea/sfep.org). A few of the largest efforts are described here.

The Napa Sonoma Marsh Project is joint State Federal and local project to restore 10,000 acres of wetlands and associated habitats within the former Cargill salt pond complex in the North Bay. It includes habitat restoration, beneficial use of recycled water, and improved water quality in the Napa River and the Bay. The Bel Marin Keys and Hamilton Airfield projects will collectively restore over 2400 acres of diked historical wetlands in the North Bay along the Marin County shoreline. These three projects, along with many smaller North Bay projects, will provide significant restoration of wetlands and associated uplands. In 2003, the State of California and the Federal government approved the purchase and restoration of 15,100 acres of Cargill's salt ponds in the South San Francisco Bay.

Acquisition of the South Bay salt ponds provides an opportunity for landscape-level wetlands restoration, improving the physical, chemical, and biological health of the San Francisco Bay. The South Bay Salt Pond Restoration Project will integrate restoration with flood management, while also providing for public access, wildlife-oriented recreation, and education opportunities. The Project will restore and enhance a mosaic of wetlands, creating a vibrant ecosystem. Restored tidal marshes will provide critical habitat for the endangered California clapper rail and the salt marsh harvest mouse. Large marsh areas with extensive channel systems will also provide habitat for fish and other aquatic life and haul out areas for harbor seals. In addition, the restored tidal marshes will help filter out and eliminate pollutants. Many of the ponds will remain as managed ponds and be enhanced to maximize their use as feeding and resting habitat for migratory shorebirds and waterfowl traveling on the Pacific Flyway.

Flood management will be integrated with restoration planning, to ensure flood protection for local communities. Where feasible, flood capacities of local creeks, flood control channels, and rivers will be increased by widening the mouths of the waterways and reestablishing connections to historical flood plains. As ponds are opened to the tide, levees between the newly created tidal marsh and local communities will need to be built or enhanced to provide flood protection.

The acquisition of such a large area of open space in the South Bay will allow for the provision of public access, wildlife-oriented recreation, and education opportunities, to be planned concurrently with restoration and flood management. Public uses could include creation of Bay Trail segments for biking and hiking, and provision of hunting and angling opportunities, bird watching, environmental education, and other recreational opportunities.

In the Suisun Marsh, the Suisun Mash Charter Group was formed in 2001 to resolve issues including recovery of endangered species, amendment of the Suisun Marsh Preservation Agreement, issuance of a USACE Regional General Permit, and implementation of a Suisun Marsh Levee Program. The Charter Group was charged with developing and analyzing a plan for the Suisun Marsh that would outline the actions necessary to preserve and enhance managed seasonal wetlands, restore tidal marsh habitat, implement a comprehensive levee protection/improvement program, and protect ecosystem and drinking water quality, consistent with the California Bay-Delta Program's goals and objectives. The proposed Suisun Marsh Plan would balance the goals and objectives of the Bay-Delta Program, SMPA, Federal and State Endangered Species Acts, and other management and restoration programs within the Suisun Marsh in a manner that is responsive to the concerns of all stakeholders and is based upon voluntary participation by private landowners. The proposed Suisun Marsh Plan also would provide for simultaneous protections and enhancement of: (1) The Pacific Flyway and existing wildlife values in managed wetlands, (2) endangered species, (3) tidal marshes and other ecosystems, and (4) water quality, including, but not limited to the maintenance and improvement of levees.

Restoration efforts focused on the upper watershed lands above the baylands are also underway. A wide variety of local groups and agencies have watershed management initiatives underway aimed at controlling pollution at the source, identifying contaminants of concern, and protecting watershed habitat. These are usually multi-objective efforts that can be addressing needs such as flood control, storm water management, habitat restoration, recreation, and open space. Local government agency and region-wide efforts are underway to control storm water runoff to Bay Region waterways, to initiate innovative land use development and agricultural practices and to improve wastewater discharges—leading to higher water quality for human and livestock consumption.

> The Bay Area Water Agencies Forum (formerly known as the Six Agencies Group) was first convened in 2000 to provide a regular opportunity for water agency policy makers to discuss regional water policy issues and explore cooperative approaches to improving the quality and reliability of Bay Area water supplies.
>
> The Bay Area Water Agencies Coalition was established in 2002 to provide a forum and a framework to discuss water management planning issues and coordinate projects and programs to improve water supply reliability and water quality.
>
> The ABAG-CALFED Task Force is a regional body of elected officials from local government and water districts, staff and non-governmental organizations that was formed to
>
> - Restore and maintain a healthy Bay;
> - Protect the legitimate interests of Bay Area communities;
> - Provide a unified Bay Area voice into the CALFED program;
>
> Help coordinate CALFED projects with the needs of Bay Area communities, and
> Help coordinate the existing Bay Area Alliance for Sustainable Development and other planning efforts with the water supply directions developed by CALFED.
>
> The ABAG/CALFED Task Force is also guided by a set of water management, regional integration, funding, environmental and representation goals. Develop a dialogue on Bay Area issues.

The Santa Clara Basin Watershed Management Initiative (SCBWMI) is one example of a collaborative, stakeholder driven effort among representatives from regional and local public agencies; civic, environmental, resource conservation and agricultural groups; professional and trade organizations; business and industrial sectors; and the general public, to protect and enhance the Santa Clara Basin watershed, creating a sustainable future for the community and the environment. The State Watershed Task Force recognized the SCBWMI as one of the top ten watershed partnerships in California through AB 2117. Its successes include the adoption of achievable and protective numeric standards for copper and nickel for lower South San Francisco Bay, adoption of wastewater discharge permits and multi-year stream maintenance permits, watershed education and outreach programs and collaborative efforts to address linkages between watershed management, flood protection and other land use and development activities.

Looking to the Future

The San Francisco Bay Hydrologic Region is home to a multitude of planning organizations that seek to identify future trends and the challenges that accompany them. These groups are working on issues of land use, housing, environmental quality, and economic development, wetlands, water reliability, watershed management, groundwater management, water quality, fisheries, and ecosystem restoration.

Most, if not all, of the water supply agencies in the Bay Region have undergone integrated water resource planning processes involving stakeholders in their regions including local land use planners and are implementing the adopted strategies to improve water supply reliability. These strategies call for the implementation of a diverse portfolio of water management actions including: conservation, recycling, desalination, conjunctive use, dry year transfers, banking and storage development.

Many local governments are now routinely evaluating or considering water supply plans as they conduct their land use planning through cooperative efforts with the agencies responsible for water supply.

However, until recently, integrated water management planning has not been coordinated among the various sub-regions of the Bay Region and has not systematically combined water supply reliability, water quality, storm water and wastewater management and environmental restoration planning together. A number of regional associations, including BAWAC, North Bay water districts, and BACWA are working under a Letter of Mutual Understandings that sets up a planning framework to develop such an integrated regional water management plan for the entire nine-county Bay Area. Parties involved in developing the report sections focusing on water supply and drinking water quality expect it to be completed by summer, 2004 while efforts to compile other sections of the report will continue.

This effort to develop a broad based multi-regional integrated water management plan for the nine-county Bay Region is very broad in its vision and scope. Although BAWAC invited other regional agencies and organizations responsible for various aspects of water management to participate, some have not been involved due to lack of funding.

Ongoing planning organizations

- The Association of Bay Area Governments (ABAG) CALFED Task Force
- Bay Area Water Agencies Coalition (BAWAC)
- Bay Area Wetlands Restoration Program
- Bay Area Regional Water Recycling Program (BARWRP)
- Fish Passage Improvement Program
- San Francisco Estuary Institute
- Audubon Society – S.F. Bay Restoration Program
- S.F. Bay Area Pollution Prevention Group (BAPPG)
- Bay Area Stormwater Management Agencies Association (BASMAA)
- Bay Area Clean Water Agencies (BACWA)
- San Francisco Bay Conservation and Development Commission (BCDC)
- San Francisco Estuary Project (SFEP)
- SF Bay Area Regional Water Quality Control Board (RWQCB) – SF Bay Basin Plan

These efforts at integrating regional water management and planning can benefit the Bay Region in many ways by facilitating implementation of innovative, cost-effective and efficient multi-objectives water management solutions. For instance, by demonstrating how recycling and water use efficiency are being incorporated, they can increase public support for the plan as a whole. Through an integrated plan, the Bay Region may also better compete for funding from broader sources such as state bond funds or federal appropriations. Some of the largest projects in the region such as expansion of Los Vaqueros, will likely require multiple agencies to agree to participate and finance the effort. These types of regional agreements may be more easily reached with regional planning.

Efforts to develop a regional approach to water management can also benefit the state. As regional water management planning moves forward, regional information on current conditions and future planning is expected to become more readily available. This regional information will complement the information being developed for future California Water Plans and will be an important part of measuring the performance of the CALFED Bay-Delta Program at meeting water quality and supply reliability goals. It will also help the State and federal government target expenditures at the highest priority regional needs.

Future Bay Region regional profiles are expected to incorporate information from integrated regional water management plans.

Environmental Water Quality

More monitoring and studies are needed to determine the effects of contaminants, including the emerging contaminants, on the aquatic ecosystem of the bay. There are many challenges ahead to improve the water and sediment quality. As the population continues to grow in the bay area, stormwater runoff, particularly from urban areas will need to continue to improve and reduce contaminant loads to the estuary. TMDLs are being developed to try to address some of the major sources of contaminants such as PCBs and mercury, from both the bay and central valley. However, even if all the sources of these contaminants were removed, it would take a long time before sediment contaminants were reduced by degradation, transport to the ocean or atmosphere, or buried under new sediment deposits. Continued monitoring is needed to evaluate the effectiveness of management actions, detect long-term trends and investigate emerging issues from new contaminants.

Wetlands and Watershed

With the large scale wetlands restoration underway around the Bay, there will need to be on-going monitoring and adaptive management to ensure that projects are meeting environmental objectives and integrating well with other water management objectives.

Water Portfolios for Water Years 1998, 2000 and 2001

The following tables present actual information about the water supplies and uses for the San Francisco Bay hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 185 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents nearly normal hydrologic conditions with annual precipitation at 110 percent of average for the San Francisco Bay region, and year 2001 reflected dryer water year conditions with annual precipitation at 85 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 3-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables included in Table 3-2 and companion Water Portfolio flow diagrams Figures 3-2, 3-3 and 3-4 provided more detailed information about how the available water supplies are distributed and used throughout this region.

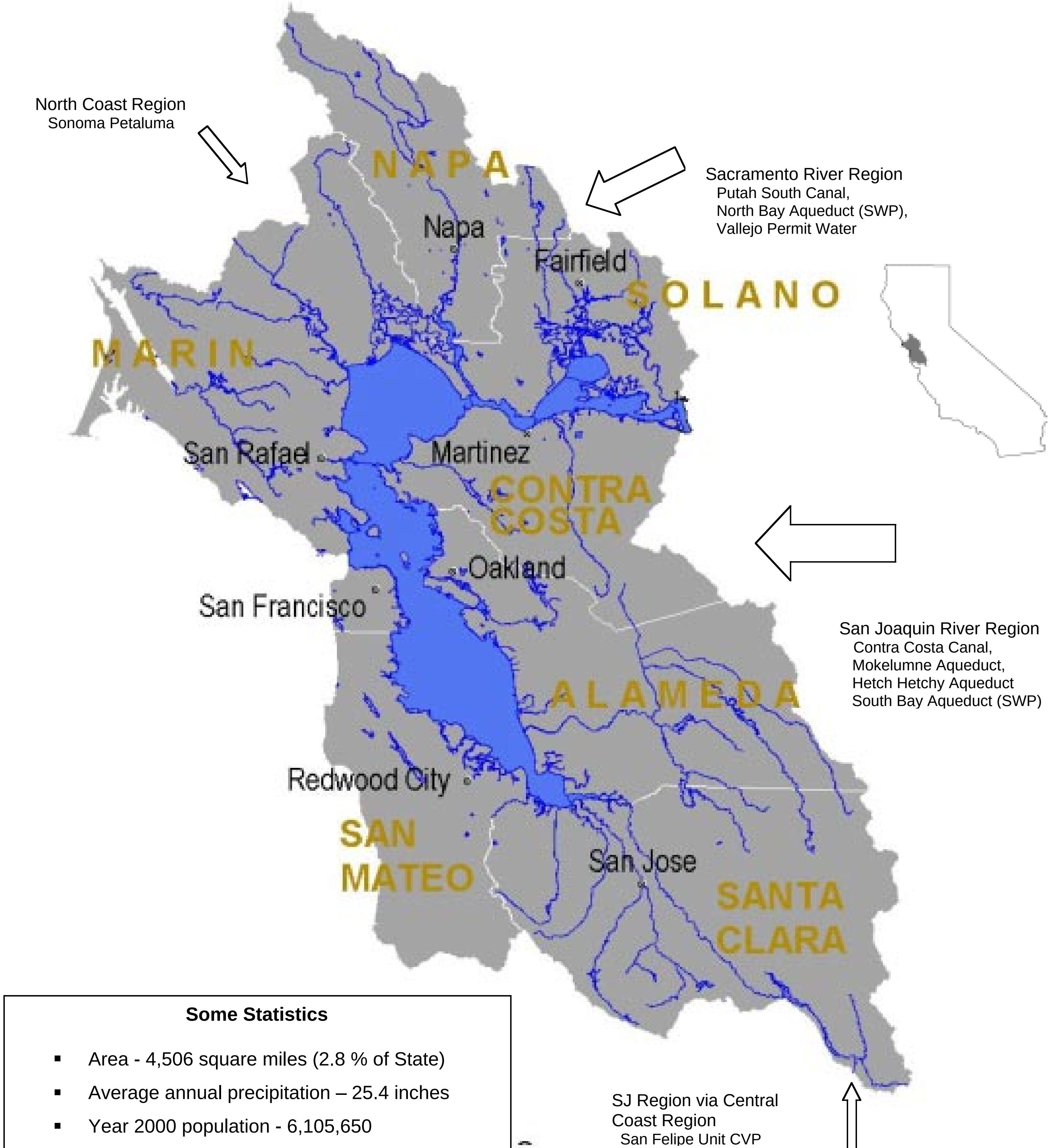
A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 3-3. Because most of the San Francisco Bay region is largely urbanized, most of the developed water is supplied to urban purposes. By comparison, agricultural and dedicated environmental water uses are a much smaller component of the total developed water uses in this region. Table 3-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems and include a large percentage of water imports from other regions.

Sources of information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of W
- ater Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- 2003 Pulse of the Estuary, San Francisco Estuary Institute

Figure 3-1
San Francisco Bay Hydrologic Region

Revised April 2, 2004



Some Statistics

- Area - 4,506 square miles (2.8 % of State)
- Average annual precipitation – 25.4 inches
- Year 2000 population - 6,105,650
- 2030 projected population –
- Total reservoir storage capacity - 746 TAF
- 2000 irrigated agriculture - 70,200 acres

Table 3-1
San Francisco Bay Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	11,438	6,644	4,908
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	309	309	274
Total	**11,747**	**6,953**	**5,182**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	384	406	430
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	0	0	0
Required Outflow to Salt Sink	23	22	20
Additional Outflow to Salt Sink	703	725	762
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	10,631	5,710	4,178
Total	**11,741**	**6,863**	**5,390**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	76	-25	-56
Change in Groundwater Storage **	-70	115	-152
Total	**6**	**90**	**-208**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	1,123	1,167	1,231

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 3-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	San Francisco 1998 (TAF)				San Francisco 2000 (TAF)				San Francisco 2001 (TAF)				Data Detail
		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	11,438.0				6,643.7				4,908.0				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		273.4				241.9				231.7			PSA/DAU
10	Local Imports		500.3				502.0				529.9			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		120.6				118.1				114.7			PSA/DAU
12	Other Federal Deliveries		38.6				34.5				37.7			PSA/DAU
13	State Water Project Deliveries		148.5				155.6				121.3			PSA/DAU
14a	Water Transfers - Regional		1.0				1.0				0.2			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		23.1				21.5				20.0			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		10.5				10.3				10.3			PSA/DAU
b	Recycled Water - Urban		5.7				5.9				5.9			PSA/DAU
c	Recycled Water - Groundwater		6.2				6.2				6.2			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		-				-				-			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		43.4				44.0				46.1			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		-				-				-			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	491.3				530.5				505.7				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	72.1				142.8				217.6				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	567.6				505.7				449.4				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				10.1				10.1				9.8	REGION
b	Evaporation from Reservoirs				104.4				103.4				98.8	REGION
36	Ag Effective Precipitation on Irrigated Lands		-				-				-			REGION
37	Agricultural Use		101.8	101.8	101.8		122.7	122.7	122.7		135.6	135.6	135.6	PSA/DAU
38	Wetlands Use		6.2	6.2	6.2		6.2	6.2	6.2		6.2	6.2	6.2	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		132.2				131.0				137.2			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		308.2				305.9				320.2			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		183.0				184.9				194.6			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		45.7				46.2				48.6			PSA/DAU
40	Urban Commercial Use		212.4				223.2				234.6			PSA/DAU
41	Urban Industrial Use		53.1				55.9				58.6			PSA/DAU
42	Urban Large Landscape		80.6				91.2				95.5			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		23.1	23.1	23.1		21.5	21.5	21.5		20.0	20.0	20.0	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		-	-	-		-	-	-		-	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				78.3				94.7				104.2	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				3.1				3.1				3.1	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				303.0				307.9				322.6	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				-				-				-	PSA/DAU
50	Urban Waste Water Produced	582.8				598.4				628.5				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				7.1				6.9				6.2	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				0.5				0.6				0.7	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				24.0				28.6				32.1	PSA/DAU
b	Return Flows to Salt Sink - Urban				675.9				693.3				726.8	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				3.1				3.1				3.1	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				23.1				21.5				20.0	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	308.7				309.2				273.9				REGION
56	Regional Exports	0.0				0.0				0.0				REGION
59	Groundwater Net Change in Storage	-70.4				114.5				-150.7				REGION
60	Surface Water Net Change in Storage	76.3				-24.8				-56.3				REGION
61	Surface Water Total Available Storage	746.1				746.1				746.1				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

DRAFT DRAFT

Table 3-3
San Francisco Bay Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	80.6			91.2			95.5		
Commercial	212.4			223.2			234.6		
Industrial	53.1			55.9			58.6		
Energy Production	0.0			0.0			0.0		
Residential - Interior	315.2			315.9			331.8		
Residential - Exterior	353.9			352.1			368.8		
Evapotranspiration of Applied Water		303.0	303.0		307.9	307.9		322.6	322.6
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		668.8	668.8		686.4	686.4		720.6	720.6
Conveyance Losses - Applied Water	14.2			13.8			12.4		
Conveyance Losses - Evaporation		7.1	7.1		6.9	6.9		6.2	6.2
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		7.1	7.1		6.9	6.9		6.2	6.2
GW Recharge Applied Water	14.4			13.6			10.4		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**1,043.8**	**986.0**	**986.0**	**1,065.7**	**1,008.1**	**1,008.1**	**1,112.1**	**1,055.6**	**1,055.6**
Agriculture									
On-Farm Applied Water	101.8			122.7			135.6		
Evapotranspiration of Applied Water		78.3	78.3		94.7	94.7		104.2	104.2
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		23.5	23.5		28.0	28.0		31.4	31.4
Conveyance Losses - Applied Water	1.0			1.2			1.4		
Conveyance Losses - Evaporation		0.5	0.5		0.6	0.6		0.7	0.7
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.5	0.5		0.6	0.6		0.7	0.7
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**102.8**	**102.8**	**102.8**	**123.9**	**123.9**	**123.9**	**137.0**	**137.0**	**137.0**
Environmental									
Instream									
Applied Water	23.1			21.5			20.0		
Outflow		23.1	23.1		21.5	21.5		20.0	20.0
Wild & Scenic									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	6.2			6.2			6.2		
Evapotranspiration of Applied Water		3.1	3.1		3.1	3.1		3.1	3.1
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		3.1	3.1		3.1	3.1		3.1	3.1
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total Environmental Use	**29.3**	**29.3**	**29.3**	**27.7**	**27.7**	**27.7**	**26.2**	**26.2**	**26.2**
TOTAL USE AND LOSSES	**1,175.9**	**1,118.1**	**1,118.1**	**1,217.3**	**1,159.7**	**1,159.7**	**1,275.3**	**1,218.8**	**1,218.8**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	273.4	273.4	273.4	241.9	241.9	241.9	231.7	231.7	231.7
Local Imported Deliveries	500.3	500.3	500.3	502.0	502.0	502.0	529.9	529.9	529.9
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	120.6	120.6	120.6	118.1	118.1	118.1	114.7	114.7	114.7
Other Federal Deliveries	38.6	38.6	38.6	34.5	34.5	34.5	37.7	37.7	37.7
SWP Deliveries	148.5	148.5	148.5	155.6	155.6	155.6	121.3	121.3	121.3
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	14.3	14.3	14.3	85.2	85.2	85.2	161.1	161.1	161.1
Artificial Recharge	14.4			13.6			10.4		
Deep Percolation	43.4			44.0			46.1		
Reuse/Recycle									
Reuse Surface Water	0.0			0.0			0.0		
Recycled Water	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4
TOTAL SUPPLIES	**1,175.9**	**1,118.1**	**1,118.1**	**1,217.3**	**1,159.7**	**1,159.7**	**1,275.3**	**1,218.8**	**1,218.8**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 3-2
San Francisco Bay Hydrologic Region 1998 Flow Diagram

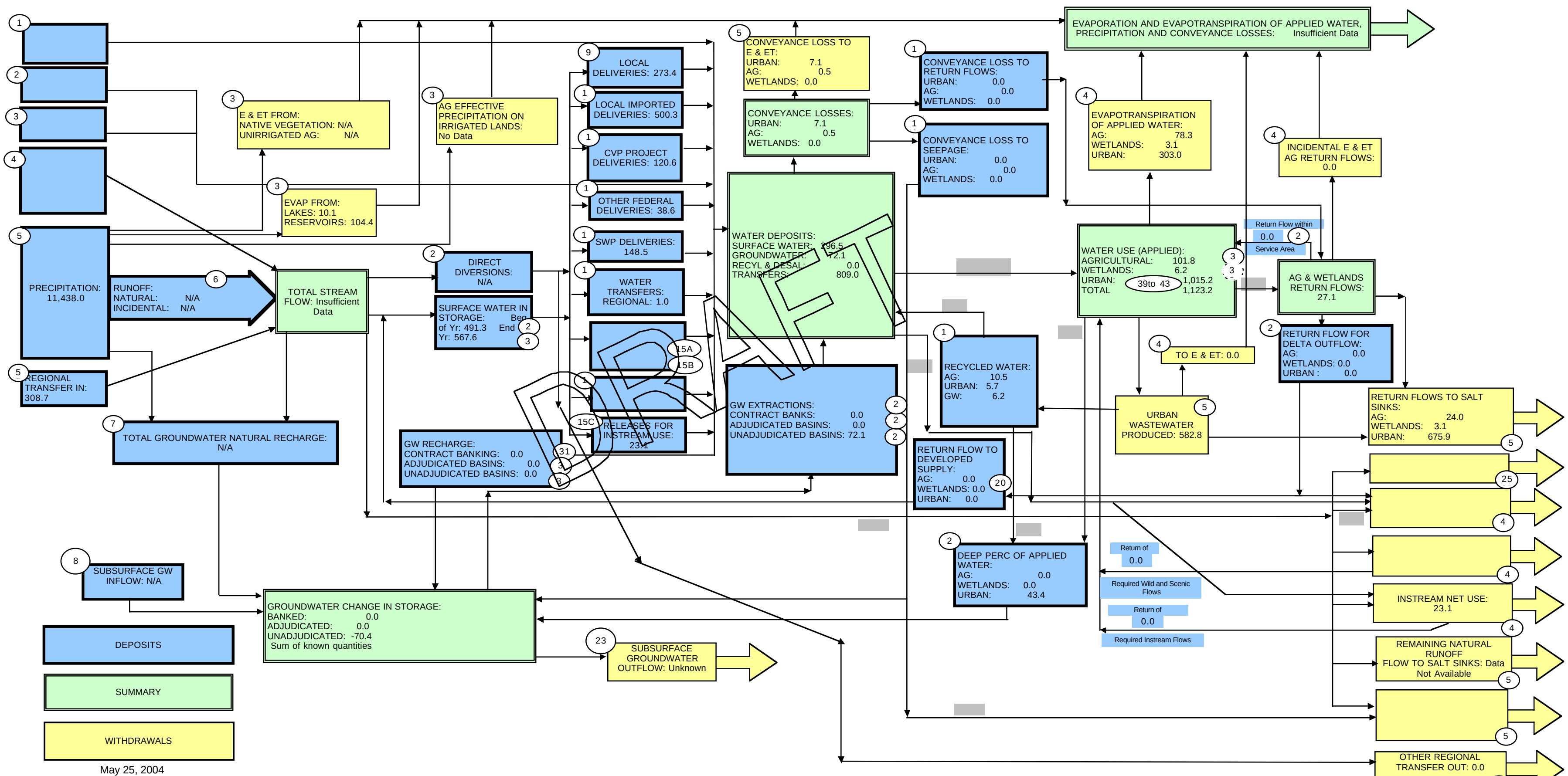


Figure 3-3
San Francisco Bay Hydrologic Region 2000 Flow Diagram

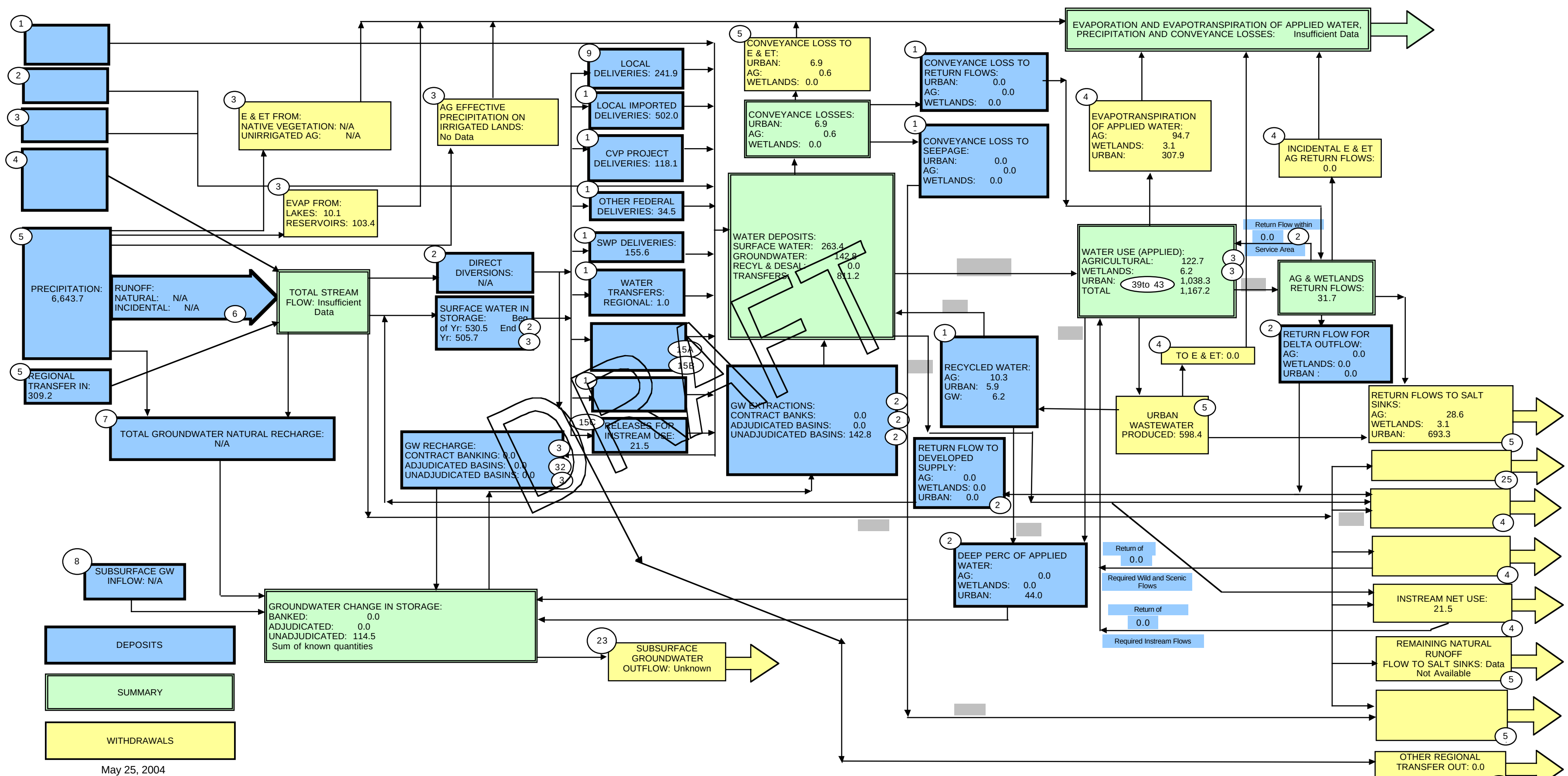
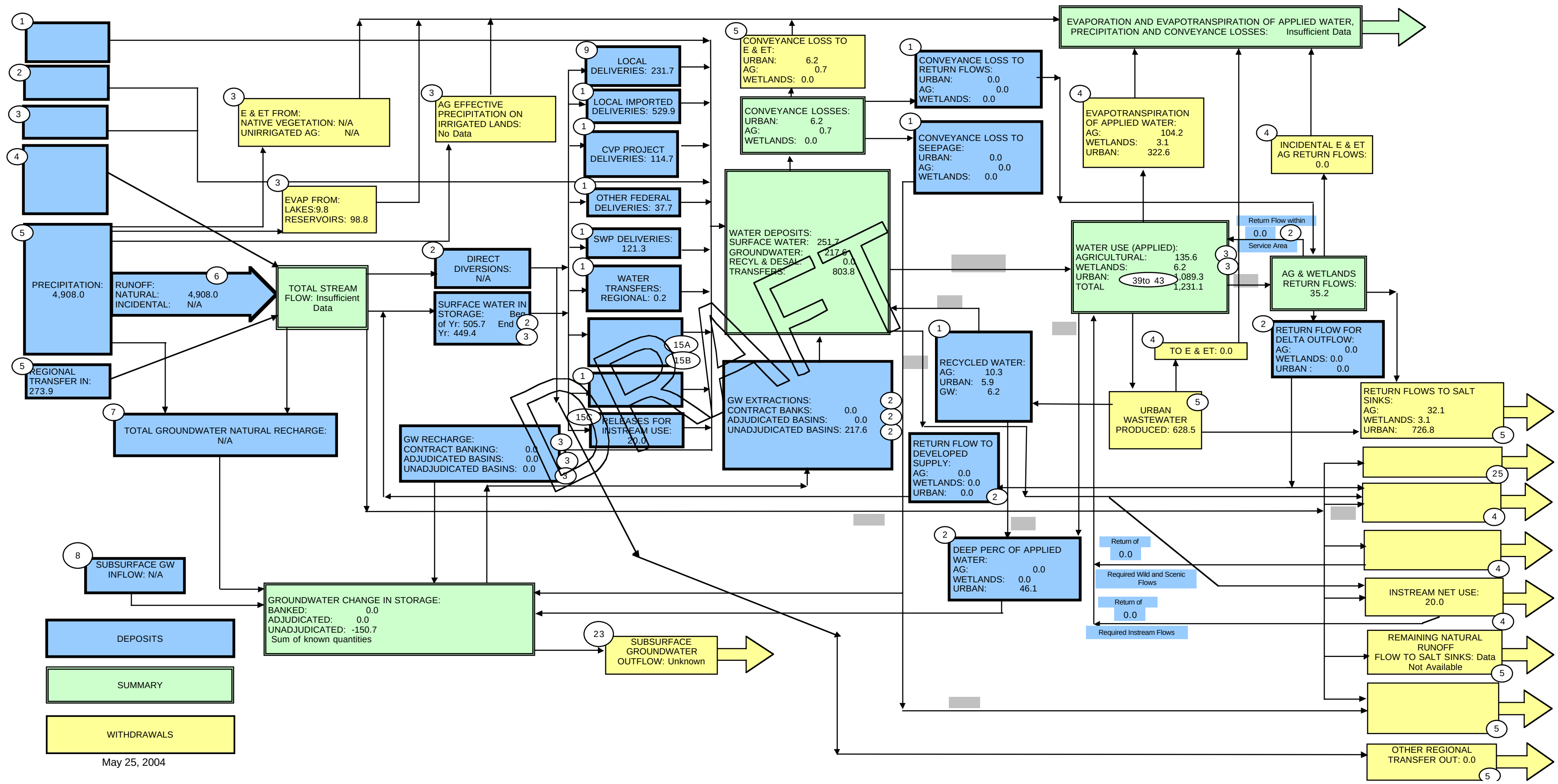


Figure 3-4
San Francisco Bay Hydrologic Region 2001 Flow Diagram



Chapter 4. Central Coast Hydrologic Region

Setting

The Central Coast Region extends from southern San Mateo County in the north to Santa Barbara County in the south (Figure 1 is a map and table of statistics that describe the region). The region includes all of Santa Cruz, Monterey, San Luis Obispo and Santa Barbara Counties and parts of San Mateo, Santa Clara, San Benito, and Ventura Counties. Many attributes define the Central Coast region including: the topography, the multitude of microclimates, the uniqueness of agricultural production, and the picturesque coastline, valleys and communities that drive a thriving tourism economy.

Most of the Central Coast Region lies within the Coast Ranges, which stretch from the northern part of the region into San Luis Obispo and Santa Barbara Counties. The component of the Coast Ranges nearest the coast is the Santa Lucia Range, where elevations of a few peaks exceed 3,000 ft. above sea level. Inland Coast Ranges are comprised of the Gabilan and Diablo Ranges in the North, the Cholame Hills in the center, and the Temblor and La Panza Ranges in the South. The San Rafael and Sierra Madre Mountains cover nearly three-quarters of Santa Barbara County. The southernmost quarter of Santa Barbara County is occupied by the Santa Ynez Mountains, which are a component of another landform, the east-west trending Transverse Ranges. The mountains in eastern Santa Barbara County attain elevations of about 7,000 ft.

Lowlands in the Region include narrow streambeds winding to the coast, coastal terraces and plains of varying sizes, and a few larger river valleys. The largest lowland near the coast is the Salinas Valley. Although less than 10 miles wide for most of its length, it stretches for 120 miles from the community of Moss Landing on Monterey Bay southeastward to near the community of Santa Margarita in San Luis Obispo County. Pajaro Valley is a smaller coastal valley adjacent to the Salinas Valley on the north side of Monterey Bay. Another large lowland near the coast is Santa Maria Valley, which straddles the Santa Maria River. Most of this valley is in Santa Barbara County, but a portion is also in San Luis Obispo County. The Salinas and Santa Maria Valleys are the premier agricultural production areas of the Central Coast. Other significant interior lowlands include San Benito Valley in the far north, the inland Cuyama Valley shared by San Luis Obispo and Santa Barbara County, and the Lompoc and Santa Ynez Valleys in Santa Barbara County. The single largest lowland in the region is the Carrizo Plain in the eastern backcountry of San Luis Obispo County. The Carrizo Plain is really just a very wide basin on the otherwise fairly narrow but notorious San Andreas Fault Zone, which runs the length of the Region.

The Central Coast's rivers generally have a northwest-southeast alignment, reflecting the aforementioned topographic trend of the Region's mountains and hills. The Pajaro, Carmel, and Salinas Rivers drain the northern part of the region, the Estrella River and San Juan Creek drain the central portion, and the Cuyama and Santa Maria River system and the Santa Ynez River drain the southern portion. All rivers drain into the Pacific Ocean.

Climate

The climate of the Central Coast remains temperate year round because of it's close proximity to the Pacific Ocean. The Central Coast has a Mediterranean climate characterized by mild, wet winters and warm, dry summers. The regional climate is dominated by a strong and persistent high-pressure system that frequently lies off the Pacific coast. The Pacific High shifts northward or southward in response to seasonal changes or the presence of cyclonic storms. Transport of cool, humid marine air onshore by winds from the northwest causes frequent fog and low clouds near the coast, particularly during night and morning hours in the late spring and early summer months. San Benito County is the only county in the region that does not have a coastline. As a result, temperature is often higher and fog less prevalent than in the coastal counties.

January is the coolest month with average high and low temperatures of 59F and 41F respectively; while September is the warmest with 72F and 52F, respectively. The best kept secret, particularly pertaining to the North Central Coast, is that the best weather occurs in September and extends through the middle of November with a few days getting into the 80s and 90s. Summer temperatures are cool along the coastline and warmer inland. In the winter, temperatures remain cool along the coast but become cooler inland. The year-round frost-free climate of the coastal valleys makes them ideal for production of specialty crops such as strawberries and artichokes.

Annual precipitation in the region ranges from 14 to 45 inches, usually in the form of rain. Most of the rainfall occurs between late November and mid April. The average annual precipitation near the City of Salinas is about 14 inches. The southern interior basins usually receive 5 to 10 inches per year, the mountain areas receiving more than the valley floors. The vineyard growing areas in both sub-regions have summers that are long and cool being situated very close to the Pacific Ocean. High quality wine grapes thrive in this environment with very moderate climate all summer, with foggy mornings, bright sunshine from mid-day through the afternoon, and very windy afternoons and early evenings.

The Monterey Area, in general, enjoys the mildest climate with the least extremes of temperature (fewest hot and cold days) of any place in the continental United States. A prevailing feature of summertime weather is the coastal fog or stratus overcast that affects most of the area. The low overcast/fog usually burns off in the late morning and moves back in before midnight. During the winter, the coolest areas are inland away from the ocean. Winds are lightest in the winter and highest in the summer, except for occasional storm systems.

The most prominent feature in the region is the floor of the Salinas Valley, which is approximately seven miles wide at Chualar, nine miles wide at Greenfield, and four miles wide at King City. The microclimate in these coastal areas(Salinas, Pajaro, and Santa Maria Valleys) is ideal and are known for the production of lettuce, broccoli, mushrooms, strawberries, and citrus, along with numerous other crops. The microclimate in these coastal areas is also ideal for the floral industry and grape vineyards, planted by world-famous vintners.

At the very southern end of the region is Santa Barbara County. Summers are warm and dry; the winters are cool and often wet. The county has a unique physical orientation, with a series of east-west transverse mountain ranges. This produces a profound orographic effect when a storm approaches the county from the Pacific Ocean. Most precipitation occurs between November and March. For the most part, Santa Barbara County receives relatively gentle but steady rainfall during storm events. Moist air from the Pacific Ocean moderates temperatures in the coastal areas; somewhat lower winter minimums and higher summer maximums prevail in the inland valleys.

Population

The population of the Central Coast Region was approximately 1,456,000 in 2000 slightly more than 4 percent California's total population. About 65 percent of the Central Coast population resided in incorporated cities. The big cities of the region are Salinas (143,800) Santa Barbara (89,600), Santa Maria (77,400), Santa Cruz (54,600), San Luis Obispo (44,200), Lompoc (41,100), Watsonville (44,300), Hollister (34,400), Monterey (29,700), Atascadero (26,400), and El Paso de Robles (24,300). There are several cities in the region with populations of less than 20,000.

California experienced a population increase approaching 15 percent from 1990 to 2000, while the growth in Central Coast region was slightly less than 13 percent. Most of the counties in the Central Coast region reached double digit population growth rates over this ten year period. The only county with a growth rate below double digits, according to Department of Finance population statistics, was Santa Barbara County which grew by only 8 percent. San Benito County far exceeded all other counties recording a 45 percent increase during the decade. The population growth rates for Monterey County, San Luis Obispo County and Santa Cruz County were 13 percent, 14 percent, and 11 percent, respectively.

Population growth in the region is largely constrained by land use policy, which limits housing supply. The cost of homes in most of the region is well above the national average, with the mostly costly real estate occurring in the proximity to the Santa Cruz and Monterey Bays, Santa Barbara and greater Salinas area. As with most communities facing extremely high real estate prices, there is a lack of entry and mid level housing. Prices have been driven upward due to lack of development coupled with high demand from many people from the Los Angeles and San Francisco areas. The high cost of housing in the City of Santa Barbara is resulting in a 'flight to affordability', as increasing numbers of workers are commuting into Santa Barbara daily from Santa Maria and the Santa Ynez Valley. Likewise, workers commute from/to Salinas, Hollister and some locations in the San Joaquin Valley, such as Tracy, Los Banos, Patterson, and Modesto.

Land Use

The busy topography of the Central Coast Region and distance from California's major population centers have resulted in a landscape that is primarily pastoral and agricultural. Major economic activities include tourism, agricultural-related processing, as well as government and service sector employment. Oil production and transportation sites onshore and offshore are important to the economy.

Cities in the region are predominantly located on bays and terraces along the coast, but some are located in the interior Salinas and Santa Ynez River Valleys. Most of the other interior valleys in the region support only small population clusters among scattered rural residents.

In general, the Central Coast's agriculture has two major components; one is irrigated vegetable and specialty crops grown on coastal terraces and valleys and in some inland valleys, and the other is range pasture and dry-farmed grain in the inland valleys. Wine grape acreage has expanded vigorously in the Central Coast in recent years and represents the region's highest value individual agricultural commodity. Vineyard acreage region-wide grew 36 percent between 1998 and 2001. Although wine grapes are the highest value individual agricultural commodity in the region, vegetable crops as a group are even more valuable. Livestock operations, mainly cattle, are also significant in the region.

Total irrigated agricultural land acreage in the Central Coast Region has only slightly increased from 406,700 acres in 1990 to 424,500 acres in 2000 (4.4 percent). Total crop acreage increased from 503,200 acres in 1990 to 589,600 acres in 2000, a 17.2 percent increase. Total agricultural land acreage has not changed significantly, but total crop acreage has increased due to an increase in the multiple cropping of vegetables.
Acreage of field crops has been declining for quite a few years. It is rare to find any sugar beets grown in the region and the two processing plants in Spreckles and Santa Maria that used to take delivery of local sugar beets have both closed. Other field crops that have seen significant declines are corn, alfalfa, and irrigated pasture. The acreage of truck crops has increased dramatically. Lettuce acreage has seen a tremendous increase in total acreage. In 1990, the reported acreage of lettuce by the Monterey County Agricultural Commissioner's office was 58,000 acres, and in 2000, it was 106,000 acres. Value added products such as packaged salads, baby lettuce mixes, and specialty bag mixes have created a large demand for the many types of lettuce grown in the region, as well as for specialty greens.

The two premier vegetable-growing centers in the region are the amazingly productive Salinas Valley in the north and the smaller Santa Maria Valley in the south. Year-round multiple cropping is the rule in these areas. The results from a multiple cropping field study conducted by the Department of Water Resources in the Salinas Valley in 1997 indicated that over 100,000 acres of land was multiple cropped, which is about 40 percent of the irrigated land in the Northern sub-region.

The entire region was home in 2001 to over 200,000 acres of land devoted to the production of irrigated vegetables and specialty crops, and produced, through multiple cropping, over 300,000 acres of specialty crop product. From 1992 to 1998, the Region lost over 14,400 acres of agricultural land to urban uses (CA Dept. of Conservation figures). However, growers have compensated for the agricultural land losses by increased multiple cropping and the use of non-irrigated pasture lands.

Citrus and subtropical fruit crops, chiefly avocados and some lemons, are grown on nearly 16,000 acres in the region, predominantly in the South. More than three-quarters of the acreage are located around Santa Barbara. Nearly 5,500 acres of irrigated deciduous fruit trees, mostly walnuts, are grown in the region, too, largely in San Luis Obispo County. About 60 percent of the vineyard acreage is in the northern part of the region; however, the acreage grew from about 14,000 to 27,500 acres in the southern part from 1998 to 2001. Total grape acreage in the region expanded from 46,000 to 67,500 acres between 1998 and 2001. Wineries with wine-tasting rooms have become an important component of the region's travel and tourism industry.

Publicly-owned lands, including military reservations, federally-managed areas, and parks, constitute about 28 percent of the Central Coast's total area. The main environmental water use is for the Salinas River National Wildlife Refuge, which is on 366 acres where the Salinas River empties into Monterey Bay.

The Refuge is part of the San Francisco Bay National Wildlife Refuge Complex, which has its headquarters in Fremont, California. Refuge lands include a range of terrestrial and aquatic habitats, including coastal dunes and beach, grasslands, wetlands, and riparian scrub. Because it is within the Pacific Flyway, the Refuge is used by a variety of migratory birds during breeding, wintering, and migrating periods. It also provides habitat for several threatened and endangered species.

Water Supply and Use

Groundwater is the primary source of water supply in the region, accounting for 84 percent of the annual supply in 2000. Local surface water supplies are a distant second. Furthermore, groundwater recharge is provided by the Pajaro, Salinas, and Carmel Rivers, and by the Arroyo Seco. Also, water impounded in local reservoirs is managed to provide groundwater recharge. San Clemente and Los Padres Dams on the Carmel River (Monterey County), San Antonio Dam on the San Antonio River (Monterey County), and Nacimiento Dam on the Nacimiento River (San Luis Obispo County) are the region's main surface water storage facilities.

Water agencies in the northern sub-region include Monterey County Water Resources Agency, Monterey Peninsula Water Management District, Marina Coast Water District, California-American Water Company, California Water Service Company, Sunnyslope County Water District, Pajaro Valley Water Management Agency, City of Santa Cruz, and San Benito County Flood Control and Water Conservation District. Water agencies in the southern sub-region include the San Luis Obispo County Flood Control and Water Conservation District and the Santa Barbara County Flood Control and Water Conservation District and numerous cities, special (water) districts, community services districts, and public utility companies. The Central Coast Water Authority includes many of these water entities.

Virtually all applied irrigation water was groundwater until water from the CVP's San Felipe Project was introduced in June 1987. The CVP's contracts for deliveries to the Santa Clara Valley Water District and the San Benito County Water District through the San Luis Reservoir total 196,300 af/yr (138,250 af/yr for M&I and 58,050 af/yr for Ag). There are two other USBR projects in the region. The Cachuma Project provides Santa Ynez River water to the communities of Carpinteria, Goleta, Montecito, Santa Barbara and Santa Ynez from the 190 taf Cachuma Reservoir (Bradbury Dam) through the Tecolote Tunnel and South Coast Conduit. Another federal reservoir, the USACE's 26 taf Santa Margarita Lake (Salinas Dam) provides a water supply for the City of San Luis Obispo. Imported supplies also come into the region via the SWP's Coastal Branch Aqueduct, which delivers 70.5 taf/yr into San Luis Obispo and Santa Barbara Counties.

The California-American Water Company, which is the primary water supplier to most of the Monterey Peninsula, diverts water from the San Clemente Dam on the Carmel River, the company's primary source of water. The 67-foot-high San Clemente Dam was built 15 miles from the mouth of the Carmel River in 1921. San Clemente was originally designed to hold up to 2,260 acre-feet of water, but over the years the dam storage capacity has been reduce by sediment transported from upstream. Furthermore, forest fires over the years created heavy erosion that added to the silt, and so much is impounded behind the dam that it now can hold only 125 acre-feet of water or about 5.5 percent of it's original capacity. When and where Cal-Am takes water from the Carmel River is tightly regulated and local agencies and groups have been attempting for years to formulate a plan to bring some stability to the local water supply.

The City of Santa Cruz meets some of its water supply demands with surface water from three sources: Loch Lomond, the San Lorenzo River, and from Coastal sources. The City of Watsonville diverts and treats surface water supplies from the Corralitos and Brown Creeks.

Desalination of seawater is another source of supply available in this region. There are 7 existing seawater desalting plants along the central coast. Of these, only 1, Marina Coast Water District, is in continuous use to provide municipal water for the California mainland. The other 8 provide water for offshore islands or for industrial use. In the Central Coast Region, an additional 4 seawater desalting plants of greater than 1 million gallons per day in capacity are in various stages of planning. These four plants will total about 19.2 mgd, or about 20,000 acre-ft per year. The plants under consideration include Santa Cruz (2.5 mgd), Monterey (Moss Landing, 9 mgd), Marina (2.7 mgd expansion to 300 mgd total), and Morro Bay (5 mgd private development). There are additional smaller plants also being considered in the Monterey and Cambria area.

The 1987-92 drought resulted in the construction of several seawater desalting plants in the region. The City of Santa Barbara constructed an 8 mgd plant that was to provide water during periods of water shortage. The plant is inactive and most, if not all, its equipment has been removed. A small plant was constructed for the Department of Parks and Recreation at the San Simeon Beach State Park to serve the Hearst Castle Visitor's Center. That plant was removed when a firm surface water supply was acquired. The City of Morro Bay constructed a plant and operates it intermittently during water short periods. The Marina Coast Water District constructed and operates a seawater desalting plant continuously as part of their regular water supply.

Water recycling is becoming a more important resource for water purveyors in the region. For example, Santa Barbara County has three wastewater treatment plants that recycle wastewater for reuse in the community for toilet flushing, agricultural and landscape irrigation, and dust control and compaction at construction sites. These communities expect to increase the amounts of recycled water used in the future. In addition, Laguna Sanitation District is currently designing wastewater treatment and recycled water distribution facilities that will be used to serve a golf course and several other irrigation water customers within the City of Santa Maria.

Agriculture is the main user of water supplies in the region, accounting for 64 percent of the region's total water use, while environmental water use was 16 percent and urban water use was 20 percent. Per capita water use in many parts of the Region remains at or below that of the late 1980s. The noticeably sharp decline could be traced to the aggressive implementation of water use efficiency programs and mandatory reductions in use during the 1987-1992 drought. The City of Santa Barbara is good example of this. Shortages from one of its sources of supply, the Cachuma Project, forced the City to intensify its conservation/rationing program activities and implement mandatory cutbacks for its customers. In 1988, the average daily per capita water use for the City was estimated at 164 gallons. That value dropped to 94 gallons in 1990. For 2000, the estimated value was 133 gallons per day.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, groundwater makes up a substantial portion of the water supply in the region. The data seem to show that the surface water supply and accompanying water uses are out of balance. This is indicated by the negative groundwater use values for each of the three years. See Table 4-1, Central Cost Hydrological Region Water Balance Summary.

State of the Region

Challenges

With the Central Coast's limited surface supply and few surface water storage facilities, the growing demand for water is causing an increased dependence on the region's groundwater resources. Because groundwater extractions have exceeded groundwater replenishment, seawater has advanced into some coastal freshwater aquifers, degrading water quality. Fortunately, there are some locations within the region, such as the Seaside Groundwater Basin and the Carmel River Groundwater Basin located within the Monterey Peninsula Water Management District, where rigorous monitoring and management practices limit well production to within the safe yield of the basins, averting a seawater intrusion problem.

While groundwater quality throughout the region is generally suitable for most urban and agricultural uses, some areas experience water quality problems, including erosion and sedimentation, industrial waste discharges, nutrients and pathogens, pesticides, urban runoff, as well as seawater intrusion.

Natural resource-rich areas such as Morro Bay, Monterey Bay and parts of the Salinas Valley are the focus of water quality issues in this region. Sedimentation poses the greatest water quality threat to Morro Bay, one of 28 estuaries in the National Estuary Program. The Bay is also contaminated by pathogens (from agriculture, boats, and urban runoff), nutrients (due to fertilizers, animal wastes, and urban runoff), and heavy metals contaminating sediments (from abandoned mines in the upper watershed, as well as boat yards offshore). Elevated levels of bacteria have closed many of the shellfish growing beds in Morro Bay, and have also frequently closed beaches in Santa Cruz County and southern Santa Barbara County. To protect special areas of biological significance, waste discharges are prohibited or limited in portions of Monterey Bay and other specific coastal and ocean waters of the region. In its triennial review, the Central Coast Regional Board also identified the need to incorporate new microbiological standards for water contact recreation.

The main tributary to Monterey Bay, the Salinas River watershed, primarily faces nitrate and pesticide contamination related to agriculture, the valley's main land use. Groundwater overdraft is also a problem in the area. Seawater intrudes up to six miles inland in the shallow aquifer around Castroville.

The nearby Pajaro River watershed faces a variety of water quality threats, such as erosion (primarily from agricultural practices), urban runoff, sand and gravel mining, flood control projects, off-road vehicles, and historical mercury mining in the Hernandez Lake area. Wetlands in Elkhorn Slough, which is sandwiched between the Salinas and Pajaro and a tributary to Monterey Bay, suffer from erosion from strawberry and other cropped lands in its watershed. Elevated bacterial levels in the Slough may be associated with a large dairy and waste operation, and the over 600 year-round vessels—and their wastes—in the Moss Landing Harbor. Taken together with the re-suspension of pesticides in sediment, these pollutants have restricted shellfish growing in Elkhorn Slough.

Beyond the Salinas Valley, water quality problems (salinity, nutrients, etc.) impact other watersheds and groundwater basins in the region. Groundwater basins that are impacted by salinity include the Hollister, the Carrizo Plain, the Santa Maria and Cuyama Valleys, San Antonio Creek Valley, portions of the Santa Ynez Valley, and the Goleta and Santa Barbara. Nutrients and pathogens impact the San Lorenzo River basin, from septic systems, horse corrals, and urban runoff, as well as erosion from logging, urban development, and road maintenance.

The California-American Water Company is the primary water supplier to most of the Monterey Peninsula, and the Carmel River is its primary source of water. In 1995, the State Water Resources Control Board ruled the company did not have a legal right to about 70 percent of the water it takes from the Carmel River. Cal-Am has been forced to take more water from wells that draw from groundwater below the lower valley, keeping as much water as possible in the river. Relatively little is now taken from the river's two reservoirs behind the San Clemente and Los Padres dams. Now Cal-Am and the Monterey Peninsula Water Management District both have made separate proposals for seawater desalination plants to produce enough water to satisfy the state order — and put about 8,000 acre-feet of water a year back into the Carmel. Neither project as currently proposed will supply any water for future growth, or for in-fill housing.

Accomplishments

Many water districts have ongoing programs to evaluate, understand, and better manage their groundwater resources. Many watershed programs are underway to reduce non-point pollution, reduce stream erosion, and improve riparian vegetation. For example, the Coastal Watershed Council was formed in response to the declining health of the watersheds of the Monterey Bay region. Their mission is to restore the watersheds of the region and teach its residents how to become stewards of their local creeks and streams.

The Carmel River Basin, though small compared to other watersheds, supports a key run of steelhead, a federally listed species. The MPWMD conducts an extensive mitigation program to offset the environmental impacts of diversion from the Carmel River that are required to meet the peninsula's water needs. Activities include steelhead rescues from the drying river, fish rearing and release, riparian habitat restoration, and river bank protection. MPWMD works cooperatively with entities such as the Carmel River Steelhead Association and the Carmel River Watershed Council.

In January 2003, Pajaro Valley water officials, made a $25 million deal for water to be piped from the Central San Joaquin Valley's Broadview Water District near the City of Firebaugh in Fresno County. Because of drainage and economic problems, Broadview district farmers have allowed about one-third of their 9,100 acres to lay fallow in recent years, while selling part of their CVP water deliveries. The agreement, which is part of the Pajaro Valley Water Management Agency's plan to use imported water to halt over-pumping and, thus, seawater intrusion, will help northern Monterey County growers who raise crops on thousands of acres in the Pajaro Valley. After obtaining the approval of the United States Bureau of Reclamation, the Pajaro Valley WMA will get the rights to 27,000 acre-feet of water a year from the Central Valley Project. The deal marks the second purchase of CVP water rights by the Pajaro Valley agency. In 1999, it acquired 6,250 acre-feet from the Mercy Springs Water District, also in the Central San Joaquin Valley. The district plans to build a 23-mile pipeline from Gilroy to Watsonville to deliver the Broadview CVP water. Construction is scheduled to start in 2004, when the Broadview water deal is made final.

In 1998, the Monterey County Water Resources Agency and the Monterey Regional Water Pollution Control Agency (RWPCA) jointly completed a $78 million Salinas Valley reclamation project and Castroville seawater intrusion project. These projects consist of a 19,500 acre-feet per year tertiary treatment plant and a distribution system that provides about 13,000 acre-feet of recycled water to 12,000 acres of Castroville area farms. During the low irrigation demand periods in winter, early spring and late fall, recycled water supplies most of the water needed for irrigation. The projects will reduce groundwater pumping in the project area, thus reducing seawater intrusion. Another project that will help alleviate the Salinas Valley's seawater intrusion problem is the $18.8 million Salinas Valley Water Project. The project is a two-pronged approach that includes: (1) a seasonal rubber dam on the Salinas River near Marina to deliver more fresh water to saltwater-plagued areas near Castroville and (2) the modification of operations at Lakes San Antonio and Nacimiento to provide higher summer flows to recharge Salinas Valley aquifers. Implementation was underway at the time this report was prepared.

Relationship with Other Regions

The region receives imported CVP water from the San Joaquin River Region and imported SWP water from the Tulare Lake Region.

Looking to the future

Local water agencies in the Central Coast Region are continually maintaining, servicing, expanding, and updating their water systems. Because groundwater is the primary water source for the Central Coast Region, in addition to implementing water conservation programs, water agencies are combining groundwater and surface water components into conjunctive use projects. Some common water management techniques being considered are recycling, groundwater recovery, and water marketing.

Ongoing Planning Efforts

- Salinas Valley Water Plan
- Pajaro Valley Groundwater Management Plan
- Pajaro River Watershed Council
- Coastal Watershed Council
- Upper Salinas River Watershed CRMP
- Carmel River Watershed Council
- Carmel River Management Plan
- Seaside Basin Groundwater Management Plan

Regional Planning

Several water agencies (e.g., Marina Coast Water District and Scotts Valley Water District) are developing groundwater management plans and conducting groundwater studies to fill in information gaps about local groundwater conditions.

In its ongoing effort to implement their Basin Management Plan (BMP) Alternative B, Pajaro Valley Water Management Agency (PVWMA) has purchased rights to CVP water supplies from Broadview WD (27,000 af) and Mercy Springs WD (6,250 af), began pipeline construction to deliver Harkins Slough Project and supplemental well water to coastal growers whose wells have been contaminated by seawater, and is pursuing more than $50 million in state and federal grants to implement the BMP. The BMP includes new wells, as a supplemental supply and as a source of blend water for wastewater reclamation, and an injection/recovery program for Central Valley Project water. The Monterey Peninsula Water Management District (MPWMD) has carried out a multi-year aquifer storage and recovery test program, where excess winter flow from the Carmel River is treated and injected into the Seaside Basin for recovery during dry periods. MPWMD has also funded several hydrogeologic studies of the Seaside Basin, and is in the early phases of developing a Seaside Basin Groundwater Management Plan. The PVWMA is also pursuing new supplemental wells as a source of blend water for the wastewater reclamation component, as a supplemental supply for the coastal distribution system, and as a supplemental supply to the import project during periods of shortage. Injection of Central Valley Project water is also being considered as part of the import project component. Injection well success depends on the quality of the water injected.

Insert info from Brian on planned projects here - Many projects and studies are underway in the Central Coast Region to enhance water quality and supply. Several new ocean desalination plants, such as the desalination project in the Sand City area being studied by Monterey Peninsula Water Management District, are being investigated as potential sources of new water supplies. Many agencies are also considering recycled water projects in conjunction with the construction of new or expanded municipal wastewater treatment plants. Local water users are proposing to raise the height of USBR's Bradbury Dam (Cachuma Reservoir) up to 3 feet to provide more water supply for the enhancement of downstream fish habitat. And many watershed programs are underway to remediate pollution and sedimentation, to help flood control, and to protect and restore ecosystems.

Water Portfolios for Water Years 1998, 2000, and 2001

Water Portfolio for Water Year 1998

California experienced another year of El Nino weather patterns in 1998 (July 1997-June 1998). Because of the extensive damage caused by El Nino, the storm event ranked as the tenth costliest in California recorded history. Particularly hard hit were the coastal valleys of the Northern sub-region, where many agricultural fields remained wet for the entire first half of 1998.

In the North Central Coastal sub-region, water year precipitation in the Santa Cruz area exceeded 30 inches (193.5 percent of normal), while in the south Central Coastal sub-region, the Santa Barbara NWS station measured almost 47 inches of rainfall (167 percent of normal).

Total agricultural production in the region was $3.65 billion (Monterey, Santa Cruz, San Benito, San Luis Obispo, and Santa Barbara Counties) in 1998 from 564,600 acres of harvested irrigated crops. This is only a modest increase over 1997, but it is significant considering some of the challenges that the agricultural industry faced. Most of the farming along the Central Coast involves the production of truck crops. Total truck crop acreage accounted for 72 percent of all irrigated crop acreage. The next largest crop is vineyard comprising 12 percent of irrigated crop acreage. The Salinas Valley area produces the majority of the spring and summer truck crops, particularly lettuce.

The El Nino phenomenon had such an impact on the Central Coast Region's volume of precipitation that growers in most cases had little need to irrigate during the first 4 to 5 months of 1998. The very wet conditions prevented the timely planting of many acres of truck crops. Spring rains delayed planting and negatively affected growing conditions, especially impacting head lettuce production. There was also a decrease in wine grape value due primarily to the wet cool conditions while acreage continued to increase. Strawberry acreage was slightly less that 1997 but total value rose due to the shortage early in the season, resulting in higher prices once the berries were harvested. The most significant increase in 1998 was attributed to salad products, which were up about $70 million as consumer demand grew. Head lettuce value significantly dropped primarily as a result of wet spring conditions.

The 1998 total agricultural applied water in the Central Coast Region was 822,700 AF (57% of total regional applied water). Average agricultural applied water per acre in 1998 was 1.5 af/ac. The total agricultural ETAW in 1998 was 595,100 AF. The 1998 regional average ETAW was 1.1 af/ac.

Total urban applied water (including residential, commercial, industrial, and landscape) in the region was 276,500 AF. Average per capita water use was about 176 gallons per day. Urban water use accounts for about 19 percent of the total water use in the region. Urban ETAW was 91,600 AF. In 1998 the population for the region was around 1,420,400.

Total environmental demand (instream, wild & scenic, and refuges) for the region was about 339,000 AF. This accounts for 23 percent of total uses. This is water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 1.5 maf

See Tables 4-2 and 4-3 and Figure 4-2.

Water Portfolio for Water Year 2000

The weather of water year 1999-2000 in the Central Coast Region was very close to typical. Rainfall amounts decreased in a southerly direction with Santa Cruz precipitation at about 118 percent of average (36.4 inches), Salinas at about 110 percent of average (16.5 inches), Santa Maria at about 113 percent of average (14.6 inches) and Santa Barbara at about 121 percent of average (21.3 inches).

Water conditions in the Central Coast Region watersheds were reported above normal. Average reservoir storage on May 1 was 115 percent of normal with runoff to May 1 measured at 105 percent of normal. The land acreage used for irrigated agricultural continued the past trend of remaining relatively stable. Crop acreage, however, increased seven percent from 1998 to 2000 within the region to 605,200. However, the estimated amount of multiple cropping in 2000 increased 13 percent and is reflected in the increased acreage of truck crops of seven percent from 1998. Truck crops comprised about 72 percent of total crop acreage with the next largest crop category, vineyard, comprised to 15 percent.

The 2000 total agricultural applied water in the Central Coast Region was 994,800 AF (64% of total regional applied water). This amounts to 21 percent more applied water than was estimated in 1998. Average agricultural applied water per acre in 2000 was 1.6 compared to 1.5 af/ac. in 1998. The total estimated 2000 agricultural ETAW was about 710,000 AF (19% higher than 1998). The regional average ETAW in 2000 was 1.2 af/ac.

In 2000, total urban applied water for the region was 308,500 af, which was 12 percent higher than the total applied water for 1998. Average per capita water use was about 183 gallons per day. Urban applied water accounts for about 19 percent of the total water use in the region. Total population in the region for the 2000, was around 1,456,118, an increase of about 2.5 percent over the 1998 population. Total ETAW for the year was about 102,200 af.

Total environmental demand (instream, wild & scenic, and refuges) for the region was about 260,300 AF. This accounts for 16 percent of total uses. This is water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 1.6 maf

Water Portfolio for Water Year 2001

The weather of water year 2000-2001 in the Central Coast Region was below average. Rainfall amounts recorded in Santa Cruz was 82 percent of average (25.4 inches), Salinas at about 90 percent of average (13.5 inches), King City at about 116 percent of average (12.8 inches) and Santa Barbara at about 146 of average (23.5 inches). Rainfall was scarce October through December.

Surface water conditions in the Central Coast Region watersheds were reported below average. Reservoir storage on May 1 was 135 percent of average; however, watershed runoff to May 1 measured at 70 percent of average. Crop acreage in 2001 increased seven percent from 1998, but decreased less than one percent from 2000. The total irrigated crop acreage was 605,200. In 2000 the prices of many of the core crops grown in the region experienced significant increases. However, in 2001, many of these same crops experienced production as well as price declines. Head lettuce, broccoli, cauliflower, and celery production all experienced decreases.

The 2001 total agricultural applied water in the Central Coast Region was 1,146,400 AF (75% of regional applied water). This amounts to 39 percent more than 1998 and 15 percent more than 2000. Average applied water per acre in 2001 was 1.9 af/ac compared to 1.5 af/ac. in 1998 and 1.6 in 2000. The 2001 total estimated agricultural ETAW was 803,400 AF or 35 percent higher than 1998 and 13 percent higher than 2000. The regional average 2001 ETAW was 1.3 af/ac.

In 2001, total urban applied water for the region was 287,500 af, which was 4% more than 1998 but 7 percent less than 2000. Average per capita water use was around 192 gallons per day. Urban water use accounted for about 19 percent of the total water use in the region. Total population in the region for the 2001, was about 1,476,899 (an increase of 1.5 percent in comparison to the 2000 population). Total ETAW for the year was around 94,400 AF.

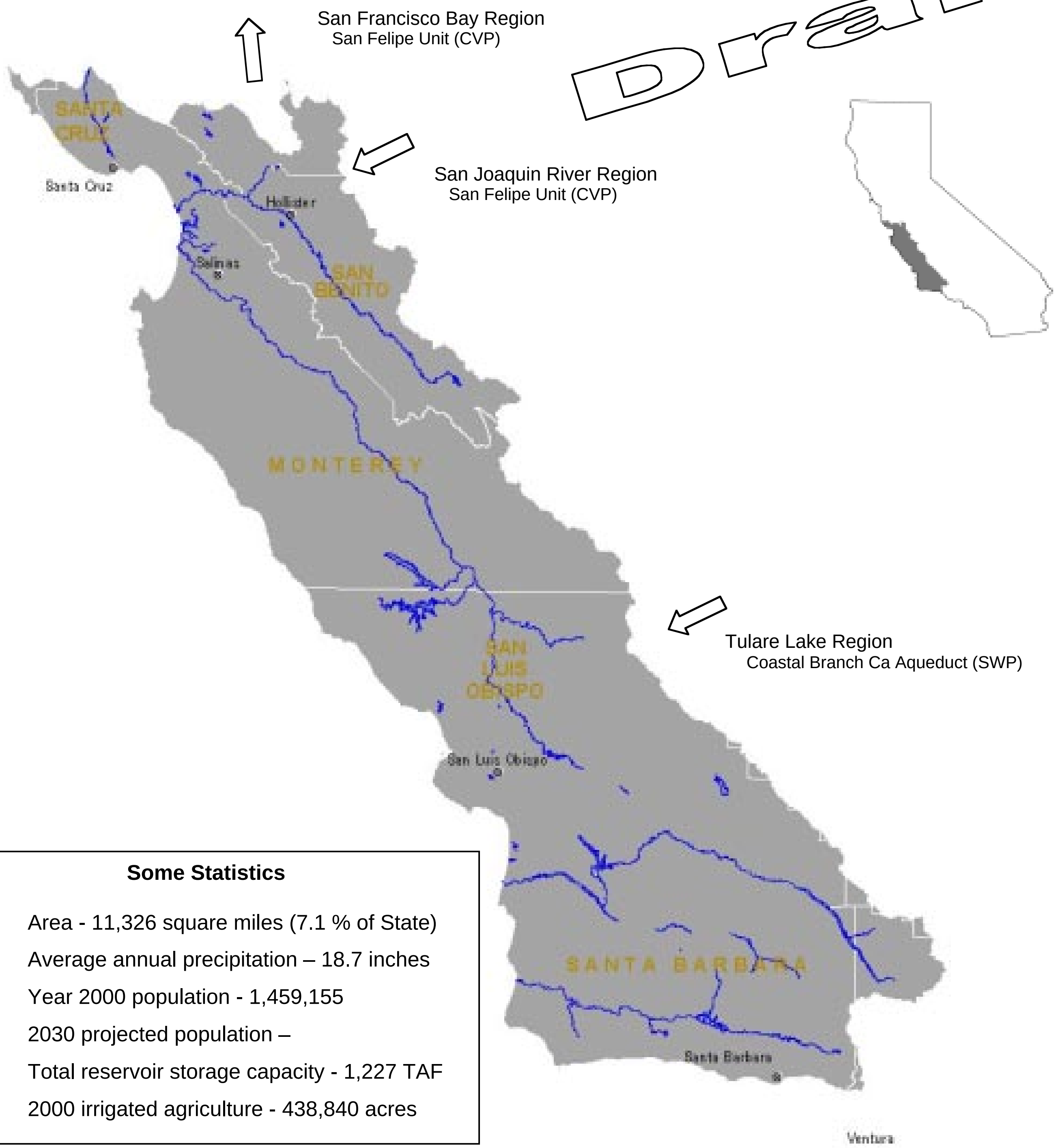
Total environmental demand (instream, wild & scenic, and refuges) for the region was about 84,800 AF. This accounts for 6 percent of total uses. This is water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 1.5 maf

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- The Californian, Salinas CA
- San Luis Obispo County Tribune
- Monterey County Herald

Figure 4-1
Central Coast Hydrologic Region



Some Statistics

- Area - 11,326 square miles (7.1 % of State)
- Average annual precipitation – 18.7 inches
- Year 2000 population - 1,459,155
- 2030 projected population –
- Total reservoir storage capacity - 1,227 TAF
- 2000 irrigated agriculture - 438,840 acres

Table 4-1
Central Coast Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	25,202	12,596	11,848
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	108	144	180
Total	**25,310**	**12,740**	**12,028**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	673	798	884
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	66	89	133
Statutory Required Outflow to Salt Sink	174	95	49
Additional Outflow to Salt Sink	130	153	156
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	24,505	12,364	11,689
Total	**25,548**	**13,499**	**12,911**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	401	8	-14
Change in Groundwater Storage **	-639	-767	-869
Total	**-238**	**-759**	**-883**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	1,099	1,303	1,434

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 4-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	Central Coast 1998 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Central Coast 2000 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Central Coast 2001 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	25,201.6				12,596.4				11,847.9				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		73.1				50.4				45.4			PSA/DAU
10	Local Imports		-				-				-			PSA/DAU
11a	Central Valley Project :: Base Deliveries		0.5				27.3				35.5			PSA/DAU
b	Central Valley Project :: Project Deliveries		17.6				23.9				19.6			PSA/DAU
12	Other Federal Deliveries		54.1				61.4				54.6			PSA/DAU
13	State Water Project Deliveries		24.6				30.9				27.7			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		20.3				21.4				10.8			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		17.5				18.5				18.5			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		23.4				26.4				32.6			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		212.1				254.2				288.8			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		53.0				62.6				64.4			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		165.4				29.9				36.2			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	589.1				770.2				778.5				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	905.1				1,085.3				1,222.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	990.1				778.5				764.5				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				10.0				11.6				10.9	REGION
b	Evaporation from Reservoirs				74.2				75.9				71.5	REGION
36	Ag Effective Precipitation on Irrigated Lands		167.8				-				-			REGION
37	Agricultural Use		822.7	610.6	616.4		994.8	740.6	744.4		1,146.4	857.6	843.2	PSA/DAU
38	Wetlands Use		0.1	0.1	0.1		0.1	0.1	0.1		0.1	0.1	0.1	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		55.5				70.0				69.9			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		69.9				77.8				72.8			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		33.1				36.9				32.7			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		17.3				20.4				17.0			PSA/DAU
40	Urban Commercial Use		48.4				54.0				46.3			PSA/DAU
41	Urban Industrial Use		26.0				22.5				20.9			PSA/DAU
42	Urban Large Landscape		12.0				12.6				13.6			PSA/DAU
43	Urban Energy Production		14.3				14.3				14.3			PSA/DAU
44	Instream Flow		20.3	-	-		21.4	-	-		10.8	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		318.6	173.5	173.5		103.2	94.7	94.7		73.9	48.5	48.5	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				580.8				695.7				789.1	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				0.1				0.1				0.1	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				91.6				102.2				94.4	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				3.2				4.3				4.9	PSA/DAU
50	Urban Waste Water Produced	43.0				50.2				46.3				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				8.6				9.6				9.4	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				11.8				14.5				16.5	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				32.4				45.2				50.0	PSA/DAU
b	Return Flows to Salt Sink - Urban				98.0				108.1				105.5	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				173.5				94.7				48.5	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	107.9				143.7				180.0				REGION
56	Regional Exports	65.8				88.9				132.7				REGION
59	Groundwater Net Change in Storage	-639.1				-767.3				-868.7				REGION
60	Surface Water Net Change in Storage	401.0				8.3				-14.0				REGION
61	Surface Water Total Available Storage	1,226.8				1,226.8				1,226.8				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 4-3
Central Coast Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	12.0			12.6			13.6		
Commercial	48.4			54.0			46.3		
Industrial	26.0			22.5			20.9		
Energy Production	14.3			14.3			14.3		
Residential - Interior	88.6			106.9			102.6		
Residential - Exterior	87.2			98.2			89.8		
Evapotranspiration of Applied Water		91.6	91.6		102.2	102.2		94.4	94.4
Irrecoverable Losses		21.5	21.5		23.6	23.6		22.7	22.7
Outflow		81.2	81.2		89.9	89.9		87.8	87.8
Conveyance Losses - Applied Water	3.9			4.2			4.4		
Conveyance Losses - Evaporation		3.9	3.9		4.2	4.2		4.4	4.4
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**280.4**	**198.1**	**198.1**	**312.7**	**219.9**	**219.9**	**291.9**	**209.3**	**209.3**
Agriculture									
On-Farm Applied Water	822.7			994.8			1,146.4		
Evapotranspiration of Applied Water		580.8	580.8		695.7	695.7		789.1	789.1
Irrecoverable Losses		3.2	3.2		4.3	4.3		4.9	4.9
Outflow		32.4	32.4		44.4	44.4		49.2	49.2
Conveyance Losses - Applied Water	12.7			16.5			18.3		
Conveyance Losses - Evaporation		11.8	11.8		14.5	14.5		16.5	16.5
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.8	0.8		0.8	0.8
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**835.4**	**628.2**	**628.2**	**1,011.3**	**759.7**	**759.7**	**1,164.7**	**860.5**	**860.5**
Environmental									
Instream									
Applied Water	20.3			21.4			10.8		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	318.6			103.2			73.9		
Outflow		173.5	173.5		94.7	94.7		48.5	48.5
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	0.1			0.1			0.1		
Evapotranspiration of Applied Water		0.1	0.1		0.1	0.1		0.1	0.1
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Environmental Use	**339.0**	**173.6**	**173.6**	**124.7**	**94.8**	**94.8**	**84.8**	**48.6**	**48.6**
TOTAL USE AND LOSSES	**1,454.7**	**999.9**	**999.9**	**1,448.7**	**1,074.4**	**1,074.4**	**1,541.4**	**1,118.4**	**1,118.4**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	73.1	73.1	73.1	50.4	50.4	50.4	45.4	45.4	45.4
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	18.1	18.1	18.1	51.2	51.2	51.2	55.1	55.1	55.1
Other Federal Deliveries	54.1	54.1	54.1	61.4	61.4	61.4	54.6	54.6	54.6
SWP Deliveries	24.6	24.6	24.6	30.9	30.9	30.9	27.7	27.7	27.7
Required Environmental Instream Flow	173.4	173.4	173.4	94.7	94.7	94.7	48.4	48.4	48.4
Groundwater									
Net Withdrawal	639.1	639.1	639.1	767.3	767.3	767.3	868.7	868.7	868.7
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	266.0			318.0			354.2		
Reuse/Recycle									
Reuse Surface Water	188.8			56.3			68.8		
Recycled Water	17.5	17.5	17.5	18.5	18.5	18.5	18.5	18.5	18.5
TOTAL SUPPLIES	**1,454.7**	**999.9**	**999.9**	**1,448.7**	**1,074.4**	**1,074.4**	**1,541.4**	**1,118.4**	**1,118.4**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 4-2
North Coast Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

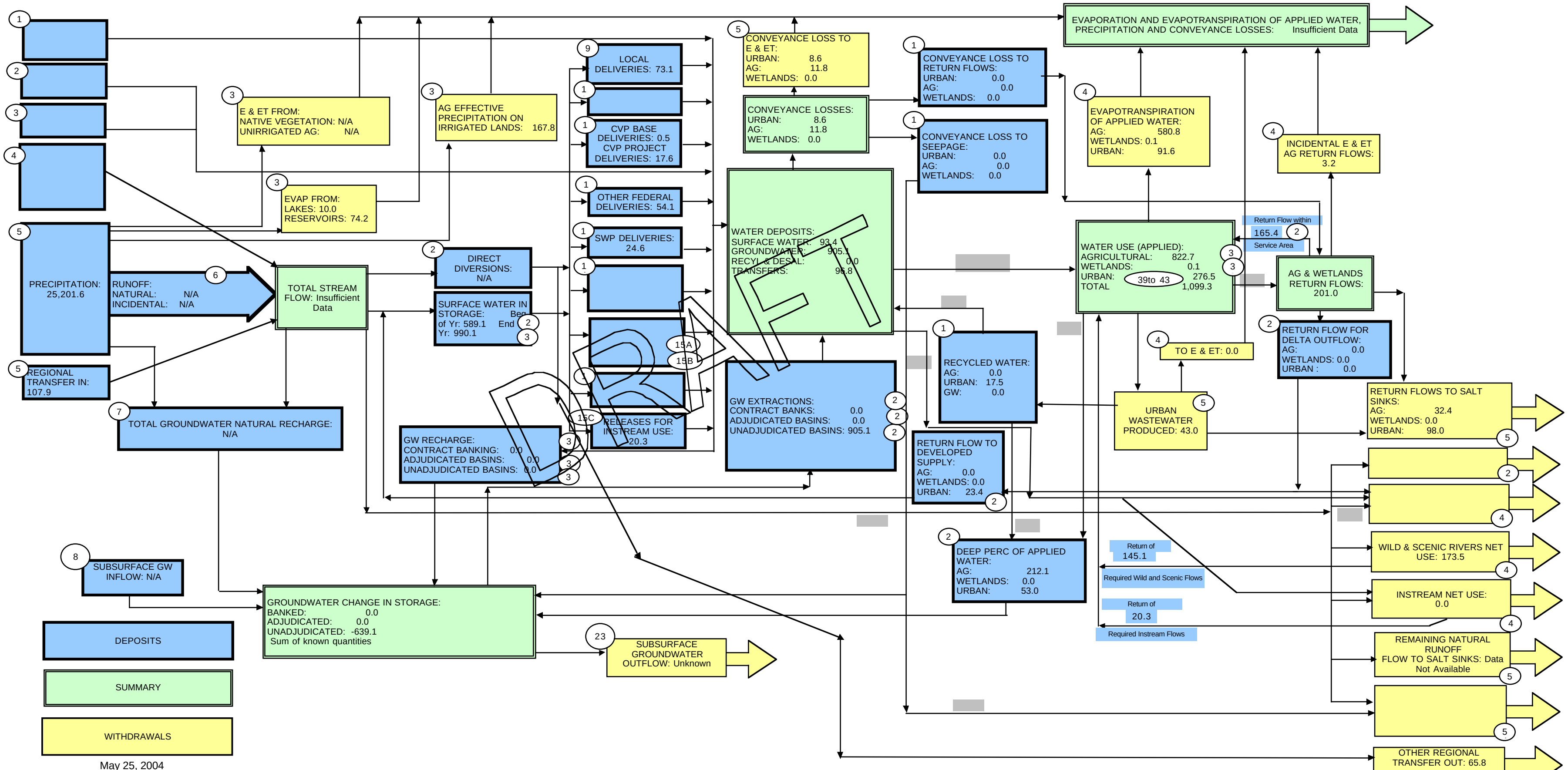
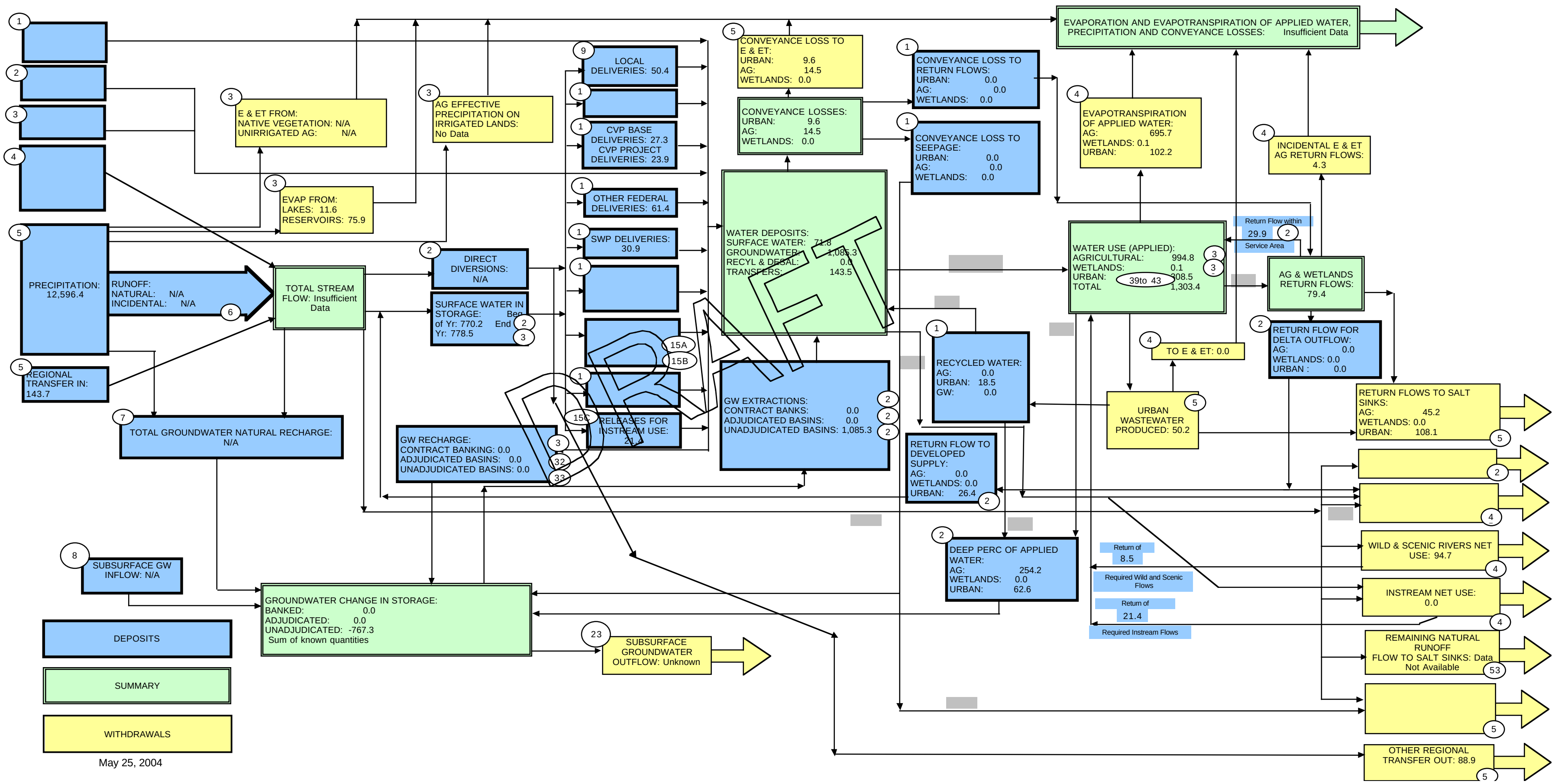
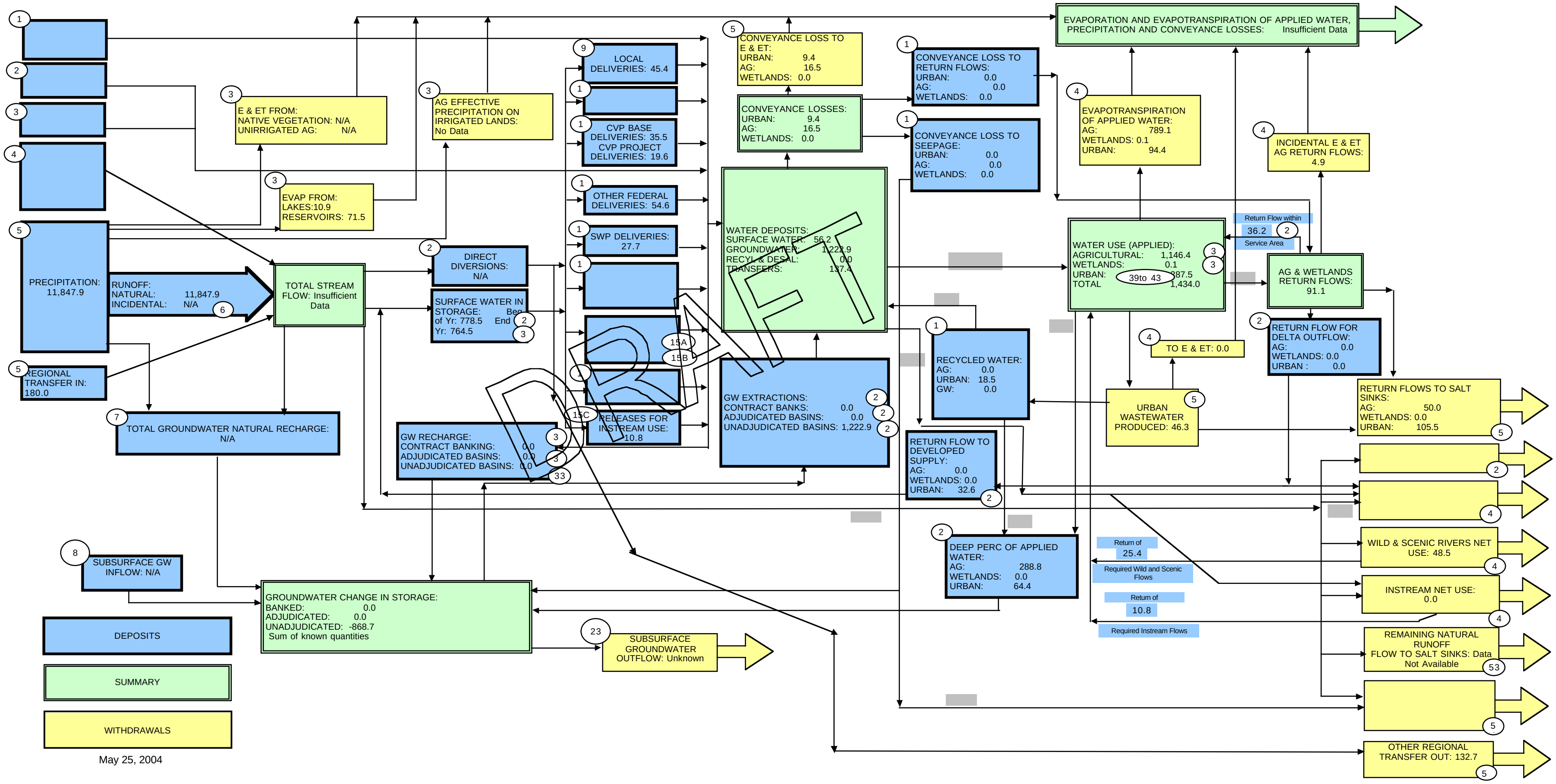


Figure 4-3
Central Coast Hydrologic Region 2000 Flow Diagram



In Thousand Acre-Feet (TAF)

Figure 4-4
Central Coast Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 5. South Coast Hydrologic Region

The South Coast Hydrologic Regional Profile may surprise some readers of past State Water Plans. Water wholesalers and retailers, groundwater agencies, and watershed planners and managers in the region are being increasingly successful in working together to implement a large and diverse array of local water supply and water quality projects, which in turn is making the region more flexible and less dependent on imported water, particularly during dry years.

This Profile, after describing the characteristics of the region, provides examples of the region's challenges, accomplishments, and plans to meet the water needs of the future. There are many more examples than are given here, but it is important to note that today there are many more major players with important roles to play in providing reliable, affordable, high quality water, and the lines between these entities are increasingly blurred.

Setting

The South Coast Hydrologic Region, located in the southwest portion of the state, is California's most urbanized and populous region. It contains slightly more than half of the State's population (54 percent), but covers only seven percent of the state's total land area. The topography includes a series of nearly flat coastal plains and valleys, many broad but gentle interior valleys, and several mountain ranges of low and moderate elevation.

The region extends about 250 miles along the Pacific coast from the Ventura-Santa Barbara County line in the north to the international border with Mexico in the south (Figure 5-1). The region includes all of Orange County and portions of Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties.

There are several prominent rivers in the region, the Sespe, Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Jacinto, Santa Margarita, San Luis Rey, San Dieguito, Sweetwater, and Otay Rivers. Some segments of these rivers have been extensively lined and in other ways modified for flood control. Natural runoff of the region's streams and rivers averages about 1.2 million acre-feet annually.

Climate

The region has a mild, dry subtropical climate where summers are virtually rainless, except in the mountains where late summer thunderstorms sometimes occur. About 75 percent of the region's precipitation falls during the four-month period from December through March. The coastal plains and the interior valleys receive, on average, 12 to 18 inches of annual precipitation, depending on the station, but the climate allows for a much wider variation from year to year. Much of the 20 to 40 inches of annual average precipitation in the higher mountains falls as snow.

Population

The Region's 2000 population was about 18,223,000. The fastest growing portion of the South Coast Region is that known as the Inland Empire, which includes the inland valleys of Riverside and San Bernardino counties. The region contains seven of the State's fastest-growing cities, in terms of percentage change (Temecula, Chula Vista, Irvine, Riverside, Fontana, Rancho Cucamonga, and

Murietta). The City of Los Angeles is the State's biggest city. Its population grew from 3,624,000 in 1990 to 3,802,000 in 2000. The population in San Diego County is concentrated along the coastal terraces and valleys, and south of Camp Pendleton, the U.S. Marine base. The City of San Diego is now America's 6th largest city, and California's second, with 1,240,000 persons.

In 1994, State Water Resources Control Board adopted Water Right Decision 1631 amending the City of Los Angeles' water rights for diverting water from the Mono Basin. The decision restricts diversions from the basin to increase and maintain Mono Lake's level to 6,391 feet above sea level. During the period of Mono Lake's transition to the 6,391-foot level (estimated to take about 20 years), the maximum amount of water that Los Angeles can divert from the basin is 16 taf/yr. Long-term Los Angeles diversions from the Mono Basin are projected to be about 31 taf/yr after Mono Lake has reached the 6,391-foot level, or one-third of the city's historical diversions from the Mono Basin.

Land Use

The mild climate and ample expanse of gentle landscapes in the South Coast Region have encouraged a variety of land uses since the first great development boom of the late 1880s. Residential and commercial development, and freeways have continued to extend their way onto lands that had long been pastoral, if not agricultural. Irrigated agriculture now occupies only a seventh as much land as urban uses. Environmental water use is primarily limited to relatively small, managed wetland areas, wildlife areas, lakes, and riparian areas.

Although the acreage devoted to its agriculture has continued to decline in recent years, the region still produced crops on about 280,000 acres in 2000, mostly high-value citrus and vegetable crops and assorted nursery products. For example, annual agricultural products in San Diego County are valued at more than $1.3 billion. The top crop production value is flowers and foliage, and an extensive citrus and avocado-growing area stretches along Interstate 5 for about thirty miles into the county. Nearly all the 36,000 acres of avocados in this hilly area are grown on slopes and irrigated with high-pressure mini-jet sprinklers and precision emitters.

Water Supply and Use

The region has developed a diverse mix of both local and imported water supply sources. An array of local projects such as water recycling, groundwater storage and conjunctive use, conservation, brackish water desalination, water transfer and storage, and infrastructure enhancements have been developed to complement imported water supplies. The region imports water through the State Water Project (SWP), the Colorado River Aqueduct (CRA), and the Los Angeles Aqueduct (LAA). This diverse mix of sources provides flexibility in managing supplies and resources in wet and dry years.

The Metropolitan Water District of Southern California (MWD) imports an average of 1.22 million acre-feet of water from the SWP and 550,000 acre-feet or more of water from the CRA (depending on the availability of surplus water). MWD wholesales the water to a consortium of 26 cities and water districts that serve 18 million people living in six counties stretching from Ventura to San Diego.

Fifteen percent of the regions water supply is provided by agencies other than MWD. These agencies import water from the SWP or provide local supplies, usually groundwater. Agencies that import SWP water include Castaic Lake Water District, San Bernardino Valley Municipal Water District, Ventura County Flood Control District, San Gorgonio Pass Water Agency, and the San Gabriel Valley Municipal Water District.

The Santa Ana Watershed Project Authority (SAWPA) is a joint powers authority located in the eastern portion of the region. It represents five agencies in the counties of Orange, Riverside, and San Bernardino and covers a watershed area of 2,650 square miles. It provides effective and concerted watershed planning on a regional basis.

Groundwater and groundwater agencies are important to the water supply picture of the region, meeting about 23 percent of water demand in normal years and about 29 percent in drought years. There are 56 groundwater basins in the region. Groundwater storage capacity is known for only 44 of these basins and is estimated to be more than 133 million acre-feet.

Water use efficiency measures, which bring wastewater agencies into partnerships with surface and groundwater managers, will play an increasingly significant role in meeting the region's water needs. It is estimated that, with the inclusion of Orange County Water District's reuse of the Santa Ana River, the region has developed over 500,000 acre-feet of annual recycled water. This is direct consumption use of recycled water that includes irrigation, industrial uses, and artificial groundwater recharge. In addition, the region uses approximately 100,000 acre-feet per year of desalinated brackish groundwater. The use of recycled water is expected to increase by 400,000 acre-feet per year during the next decade and the use of desalinated groundwater is expected to increase by approximately 150,000 acre-feet per year over the next decade.

It is interesting to note that during the latter stages of the 1987-1992 drought and for several years afterward, water supply deliveries and M&I uses for many retail water districts in the Region were slightly less than in the late 1980s. The City of Los Angeles, exemplifies this trend. For WY 1990, the City used 677.1 taf of water from various supplies. In 1998 and 2000, the totals were 596.7 and 679.5 taf respectively. The increase in water supplies in 2000 was less than one percent over the 1990 quantities despite a net increase in the population served of more than 400,000.

West Basin Municipal Water District (WBMWD), the largest water recycler in the region, has developed over 31,000 acre-feet of recycled water. Currently, about 13,700 acre-feet of recycled water is beneficially reused within the San Diego County Water Authority (SDCWA) service area annually, 94 percent for agriculture, landscape irrigation, and other manufacturing and industrial uses. The remaining 6 percent is recharged into groundwater basins.

Demand-reduction through water conservation is increasing in the region. Some of the increase is due to active programs that encourage installation of ultra-low-flush toilets and other water efficient appliances for residential, industrial, and institutional uses as well as promotion of water efficient landscaping and irrigation. Even greater conservation is achieved through so-called passive conservation brought about by changes in the water code that require manufacturers to offer customers water-saving devices. MWD reports that its members have urban programs that conserve approximately 65,000 acre-feet annually through active programs, but passive conservation makes the actual savings much larger.

Approximately 14 percent of the overall water use in the region is due to agricultural activities. The sources of water supplies for irrigation operations in the region differ throughout the region. Groundwater is the primary source of water supplies for the agricultural activities on the coastal plain of Ventura County. In the middle section, combinations of groundwater and imported water are used. In the southern portion, primarily San Diego County, imported water supplies are used almost exclusively.

MWD initiated several agricultural water conservation and transfer programs, including a program with the Imperial Irrigation District (IID) that conserved 104,049 acre-feet in 2002 and a crop rotation and water supply program with Palo Verde Irrigation District that saved about 186,000 acre-feet of water from 1992 through 1994 (a full-scale program is underway). In addition, SDCWA is in the initial stage of a project with IID that will deliver up to 200,000 acre-feet of conserved water annually to San Diego County.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, losses are about the same as precipitation and outflows to the ocean are relatively small. Imports are a large part of the applied water in the region.

State of the Region

Over the past decade, the region has improved water supply reliability in the face of reduced supplies from the Owens Valley and Mono Basin and uncertainty regarding the amount of imports from the State Water Project and Colorado River. Water agencies have been proactive in continuous planning to manage changing water supply and demand conditions in the region. While dependent on imported water for at least 50 percent of its water supplies, the region's water agencies have compiled a wide array of water management tools and water management and planning practices that bring local water resources on a more equal footing with imported water.

Challenges

Like many regions in the state, water quality and water supply challenges are inter-twined. The region must manage for uncertainties caused by population and economic growth. Growth will not only affect demand, but it will add contamination challenges from increases in wastewater discharges and urban runoff, as well as increased demand for water-based recreation. Outside the region, environmental and water quality needs in the Delta, Colorado River, and Owens River/Mono Basin systems affect imported water supply reliability and quality. The region must also assess and plan for impacts of climate variations and global climate change, as well as the cost of replacing aging infrastructure.

Given the size of the region and the diverse sources of water supply, the challenges to the region's water quality are varied. There are no single solutions, and some solutions create additional problems. Supplies such as imported water from the Owens Valley and the Delta may be high in arsenic, organic carbon and/or bromide. Colorado River water is high in total dissolved solids (TDS) and has other problem constituents, such as perchlorate, a component of rocket fuel.

Total dissolved solids concentration affects the feasibility of water recycling and groundwater recharge programs. Because residential use of water increases TDS concentration, water recycled from even moderately high TDS source water can result in unacceptably high TDS concentrations. Groundwater recharge potential may be restricted because the Regional Water Quality Control Board has established TDS requirements for recharge water in some groundwater basins to protect existing basin water quality.

The average TDS concentration of MWD's Colorado River water in 1996 was about 700 mg/L and the average TDS content of MWD's SWP supplies was about 300 mg/L. The City of Los Angeles' water supply from the eastern Sierra Nevada had a significantly lower TDS concentration, typically about 160 mg/L. TDS levels in local groundwater supplies in the South Coast Region vary considerably, ranging from 200 mg/L (Cucamonga Basin near Upland) to more than 1,000 mg/L (Arlington Basin near Corona).

Local sources of salinity also contribute significantly to overall TDS levels. Municipal and industrial use of water adds between 250 and 500 mg/L of TDS to wastewater. Key sources of local salts include water softeners (typically contributing from 5 to 10 percent of the salt load) and industrial processes.

The long-term salt balance of South Coast Region's groundwater basins is an important management concern. Smaller basins like the Arlington and Mission groundwater basins were abandoned as municipal supply because of high salinity levels. These basins have only recently been restored through brackish water desalting projects. Blending SWP and CRA supplies or using the SWP's relatively low TDS supplies for groundwater replenishment has been a goal in some areas. However, some inland agencies that reuse wastewater have salt accumulation problems in their groundwater basins because they lack an ocean outfall or stream discharge. Other inland agencies have established access to a brine line for exporting salt and concentrated wastes to a coastal treatment plant and ocean outfall, while others have not found construction of a brine line to be economical.

Water agencies treat and manage their supplies to meet or exceed all drinking water quality standards required by the state and federal laws. Pending and future EPA and state regulations will undoubtedly raise some of these standards and add new contaminants to the treatment list. Several established and emerging contaminants of direct concern to South Coast Regional water supplies include disinfection by-products (DBPs), perchlorate, arsenic, NDMA, hexavalent chromium and MTBE.

Disinfection by-products (DBPs) are regulated by the Stage 1 Disinfection/Disinfectant By-Product Rule (D/DBP Rule). The D/DBP Rule balances the need for adequate disinfection to inactivate pathogens with the need to reduce the formation of DBPs that may harmful to human health. Dissolved organic carbon (DOC) and bromide, present in SWP supplies, have forced many South Coast region water utilities to remove the DBP precursors or rely upon alternative secondary disinfectants, such as chloramines, rather than chlorine. Another DBP, bromate, is also of concern in this region when ozone is used to treat water with high levels of bromide, a natural constituent of water from the Delta.

Perchlorate has been identified in groundwater in Los Angeles, San Bernardino, and Riverside counties and in Colorado River water. Perchlorate is an inorganic constituent present in rocket fuel, which is believed to disrupt thyroid gland function in humans. Perchlorate in Colorado River water is largely due to contamination from inactive ammonium perchlorate manufacturing facilities in Nevada. Discovery of perchlorate contamination of wells in the San Gabriel Valley, which put many of these wells out of production, has led to testing of ion exchange technologies for the removal of this constituent.

Arsenic is another contaminant of concern in the South Coast Region, largely but not exclusively to the City of Los Angeles. High concentrations of arsenic present in the LAA supply and local aquifers are due to natural sources. The City of Los Angeles manages arsenic in LAA water through treatment and exchanges with MWD. Ingestion of high concentrations of arsenic in drinking water has been linked to skin disorders, circulatory problems, and increased risk of cancer. Removal of arsenic from supplies currently relies primarily on ion exchange, coagulation/filtration, and reverse osmosis processes. In southern California, water sources with high arsenic levels have also been found in Los Angeles, San Bernardino, and Riverside counties.

Nitrosodimethylamine (NDMA) is associated with the production of rocket fuel, the manufacture of explosives, and in the manufacture of paints and other industrial goods. NDMA is a contaminant of concern because it causes cancer in a variety of laboratory animals and is a probable human carcinogen. Contamination of surface and groundwater supplies from NDMA at missile and other rocket fuel sites has been characterized as a significant concern, particularly for groundwater supplies. NDMA formation during the treatment of wastewater is also a concern to drinking water supplies when wastewater is recharged into aquifers. NDMA is currently treated in drinking water supplies by ultraviolet radiation (UV).

Groundwater contamination by hexavalent chromium in the Los Angeles region and elsewhere has resulted from its use in various industries including aerospace, aircraft manufacturing, and plating. Hexavalent chromium is known to be a carcinogen by inhalation, and carcinogenic effects by ingestion are suspected. Currently, only total chromium is regulated, but California has initiated unregulated contaminant monitoring to determine how widespread hexavalent chromium contamination is in the state. Promising technologies for removing hexavalent chromium include ion exchange, coagulation/filtration, and reverse osmosis, although no technologies have yet been demonstrated on a full-scale basis. In Los Angeles County, Regional Water Quality Control Board staff is overseeing assessment and cleanup of sites impacted by hexavalent chromium at defense-related businesses and manufacturing and other industrial sites.

MTBE and other oxygenates have been added to gasoline in areas with severe air pollution to help gasoline burn more cleanly and comply with federal law. MTBE has caused public concern because it can contaminate groundwater when pipelines, fuel tanks, and other containers or equipment leak, when fuel is spilled, and when unburned fuel is discharged from watercraft. The high mobility and low biodegradability of MTBE presents significant risk to aquifer supplies when MTBE spills or leaks occur. MTBE has been detected in groundwater supplies in Los Angeles, Orange, Riverside, Ventura, and San Diego counties. It has also been detected in imported and local surface water supplies. The health effects of MTBE are uncertain, but MTBE may have potential non-cancer effects or may be a carcinogen at high doses. MTBE can be removed from drinking water supplies by air stripping, granular activated carbon (GAC), or advanced oxidation.

California's use of Colorado River water is being managed to ensure that the region reduces by 2016 the use of this water from a high of 5.3 million acre-feet in previous years to its 4.4 million acre feet annual apportionment. Until 2016, California can receive surplus water from the river depending on the storage level in Lake Mead. The California Colorado River Water Use Plan (the Plan) outlines steps to be taken to reduce the use of Colorado River water. Those steps include a water transfer of conserved water from IID to SDCWA, the lining of earthen canals, water storage and conjunctive use programs, water exchanges, improved reservoir management, salinity control, watershed protection, water reuse, and other measures.

Drought is a constant concern for water agencies in the region. This has led to an emphasis on the development of local supplies. Today, about 50 percent of southern California's demand is being met through such local supplies as water conservation, recycling, and groundwater recovery. The uncertainty caused by scientific findings on climate change also has caused water agencies to question the reliability of imported sources.

Groundwater overdraft is a challenge to the region. Historically, agricultural, industrial, and urban development has led to extraction of increasing amounts of groundwater from many of the region’s basins. Over-extraction of groundwater has caused seawater intrusion, contributed to land subsidence, and led to disputes over pumping rights in many of the region’s basins.

Local surface water quality is affected by stormwater and urban runoff, which contribute contaminants (including trash) to local creeks and rivers. The presence of contaminants, as well as the presence of inadequately treated wastewater resulting from sanitary sewer overflows, has closed beaches and affected water quality in Santa Monica, Newport, and San Diego bays.

During shipping activities, accidents such as spilling of fuels and sewage may occur, which can also affect water quality, especially at the Long Beach and Los Angeles Harbors and the U. S. Naval Port in San Diego Bay.

Accomplishments

The region has developed a diverse water portfolio that is balanced between local and imported supplies. The primary objectives of the regions water agencies are to provide high quality, reliable, and affordable water. To achieve this balance, the region has constructed additional surface storage capacity and employed several local resource management strategies including improved conveyance facilities, agricultural and urban water use efficiency, water recycling, groundwater conjunctive, groundwater remediation, brackish water desalination, drinking water treatment, watershed management, and groundwater banking and water transfers from outside the region. These diversified strategies guide the management of available resources in a manner that allows greater flexibility when adapting to water quality or supply challenges.

Diamond Valley Lake was constructed in the late 1990s to better manage water supplies between wet and dry years. The 800,000 acre-foot reservoir, located near Hemet in southwestern Riverside County, nearly doubles the region's existing surface storage capacity and provides increased terminal storage for SWP and Colorado River water supplies. Diamond Valley Lake would provide the MWD service area with a six-month emergency imported supply after an earthquake or other disaster. It would also provide water supply for drought protection and peak summer demands.

The SDCWA finished construction of Olivenhain Reservoir in 2003 and began filling its 24,000 acre-foot capacity with imported water. The reservoir, located just southwest of Escondido in northern San Diego County, will provide water to the San Diego region during an emergency that cuts off normal imported water deliveries. It is the first milestone completed in the SDCWA Emergency Storage Project, which will add 900,100 acre-feet of storage capacity within the county.

The Inland Feeder is a conveyance facility to deliver SWP water made available by enlargement of the East Branch of the California Aqueduct. Upon its completion in 2004, the Inland Feeder will deliver water by gravity to Diamond Valley Lake via 43.7 miles of tunnels and pipeline that start at Devil Canyon and tie into the CRA and Eastside Pipeline. The Inland Feeder will provide system reliability by linking the SWP and Colorado River systems and will improve water quality by allowing greater blending of SWP and Colorado River waters.

An agreement between MWD and San Bernardino Valley Municipal Water District (San Bernardino) allows MWD to purchase additional SWP water for blending with Colorado River water and to store water from San Bernardino's groundwater basin, which helps resolve long-standing groundwater issues. The San Gorgonio Pass Water Agency recently extended the pipeline east from Mentone bringing SWP water to Beaumont.

On October 10, 2003, representatives from MWD, IID, and Coachella Valley Water District (CVWD) signed the Quantification Settlement Agreement (QSA) and several other agreements that will execute several key components of the Colorado River Water Use Plan including establishing water budgets from IID and CVWD and making water transfers viable. The QSA includes a water transfer from IID to SDCWA, which began in 2003 and eventually will provide 200,000 acre-feet per year to San Diego County. The transfer will help increase water supply reliability for the South Coast Region.

State agencies, including the Department of Water Resources (DWR), the State Water Resources Control Board (SWRCB), and the California Bay-Delta Authority (CBDA), and the Federal Bureau of Reclamation are making major statewide investments in urban and agricultural water conservation programs, which regional and local agencies leverage with their own investments to reduce demand. As discussed above, additional demand reduction comes from passive conservation achieved through changes in manufacturing codes.

An example of this regional leveraging is MWD's conservation program with its member agencies. Since 1992 Metropolitan has invested more than $191 million in conservation programs and related activities. In 2003, MWD implemented a new rate structure that includes a funding source dedicated to conservation, recycling, groundwater recovery, and other local projects. The backbone of MWD's conservation program is the Conservation Credits Program, initiated in 1988, that contributes $154 per acre-foot of water conserved to assist member agencies in pursuing conservation opportunities. In tandem to these urban conservation efforts, MWD has an agricultural water savings program that began in 1990 with IID. To date, MWD has invested more than $193 million to construct, operate, and maintain projects with IID that will conserve more than 100,000 acre-feet of agricultural water every year to transfer to MWD. In 2003, water savings were 105,130 acre-feet. This agreement is for a minimum of 43 years.

A 35-year agreement for a land management, crop rotation and water supply program is in place with the Palo Verde Irrigation District and MWD. Palo Verde farmers will stop irrigating between 7 to 29 percent of their land, on a rotating basis, securing about 8 to 36 billion gallons of water each year for use in southern California. MWD will provide an estimated $6 million to local community improvement programs to counter potential negative economic impacts to the Palo Verde community.

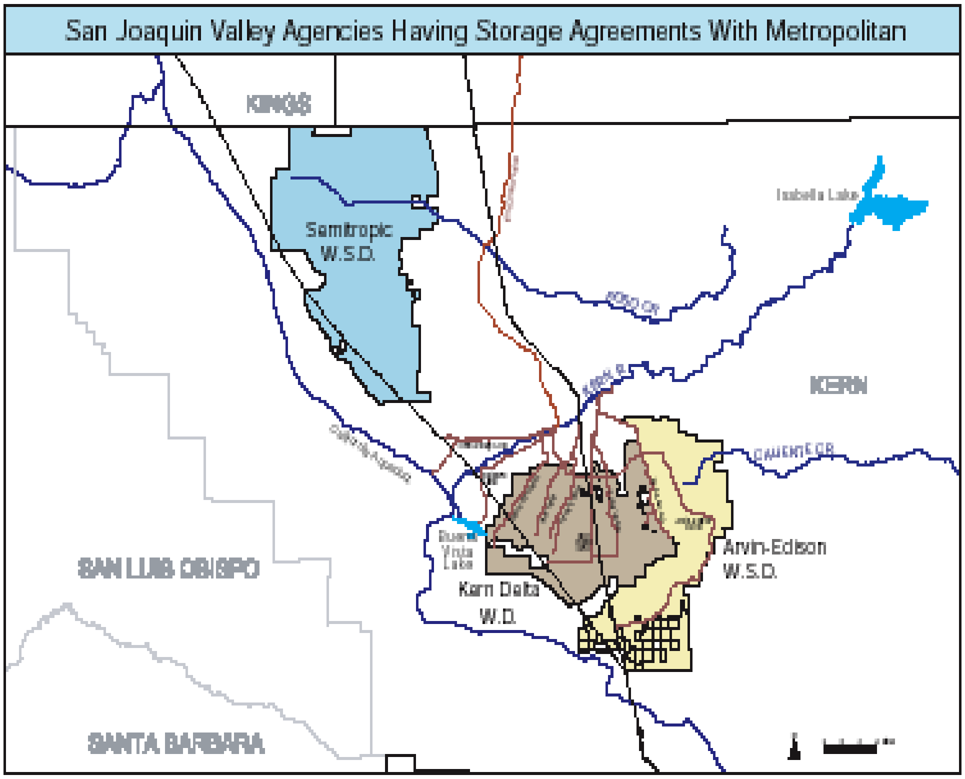
Over $440 million, primarily from State Propositions 13 and 50 and federal Title XVI grants, have been invested in water recycling programs in the region, resulting in over 500,000 acre-feet of water available per year, including Orange County Water District's (OCWD) current reuse of Santa Ana River water. The growth in recycled water will be about 400,000 acre feet over the next decade.

The OCWD's new Groundwater Replenishment (GWR) System is designed to increase current water reuse by taking treated sewer water that is currently being released into the ocean and purifying it through microfiltration, reverse osmosis, and ultraviolet light with hydrogen peroxide advanced oxidation treatment. The purified water will be injected into a seawater barrier and pumped to percolation ponds to seep into deep aquifers and blend with Orange County's other sources of groundwater.

The development of groundwater storage and conjunctive use programs has improved the region's water supply reliability and overall water quality. A 2000 study by the Association of Groundwater Agencies indicates that existing conjunctive use programs in the region provide an estimated 2.5 million acre-feet of water per year, which is a small fraction of the region's conjunctive use potential. It is estimated that over 21.5 million acre-feet of additional water could be stored and used in southern California groundwater basins with the resolution of institutional, water quality, and other issues. State agencies have supported the development of 34 groundwater management and storage projects in the region.

As a result of MWD's replenishment services pricing program, local agencies are implementing conjunctive use programs. They are storing imported water in groundwater basins and increasing their groundwater use during the summer and during drought years. It is estimated that an average of 100 thousand acre-feet per year of groundwater supply is now produced as a result of MWD's discount pricing deliveries. MWD has identified the potential for 200 thousand acre-feet of additional groundwater production during drought years. To accomplish this additional drought year production, about 600 thousand acre-feet of dedicated storage capacity within the local basins may be required.

An example of such a conjunctive use program is the Las Posas Basin Aquifer Storage and Recovery Project. The Calleguas Municipal Water District, in cooperation with MWD, has initiated a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. The project is designed to store a maximum of 210,000 acre-feet of SWP water supplies that can be used during water supply shortages. The project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been constructed and approximately 50,000 acre-feet of water is in storage.



San Joaquin Valley Agencies Having Storage Agreements With Metropolitan

More recent groundwater storage agreements allow additional storage in wet years. Groundwater agreements to be implemented in the region will put more than 53 billion gallons of water into storage in Orange County, the west San Gabriel Valley and the Inland Empire. MWD reached agreements the Kern-Delta Water District, the Mojave Water Agency, and the North Kern Water Storage District, outside the region, where it also participates in the Semitropic Water Banking and Exchange Program in Kern County, the Arvin-Edison Water Storage Program in Kern County, and the Kern-Delta Storage Program. Castaic Lake Water Agency entered into a short-term groundwater banking arrangement with Kern County.

Groundwater quality issues are being addressed in the region. In the San Gabriel Valley, the Main San Gabriel Basin Watermaster, San Gabriel Basin Water Quality Authority, Upper San Gabriel Valley Municipal Water District, and a number of water suppliers have actively pursued technical remedies for the groundwater quality problems described earlier. Several treatment facilities for the VOCs were first constructed in the 1990s. As of June 2002, 18 treatment facilities are operational. Groundwater supplies with high nitrate levels are either blended with other supplies or not used at all. Similar cleanup efforts are being pursued in the San Fernando Basin by LADWP and the Upper Los Angeles River Basin Watermaster.

Brackish groundwater desalting delivers about 100,000 acre-feet of water today and will increase to approximately 250,000 acre-feet during the next decade.

Several groundwater desalting plants are currently operated by the SAWPA, Chino Basin Desalting Authority, City of Corona, Eastern Municipal Water District's, Irvine Ranch Water District, the City of Oceanside, West Basin MWD, and the Sweetwater Authority. . Proposition 13 water bond funding is being utilized to expand desalting capacity in the region.

SAWPA operates a brine disposal line, which facilitates disposal of waste brine from regional desalting plants and operates the Arlington Desalter. SAWPA has been particularly successful in recent years in assisting its member agencies in implementing several new water resources projects that enhance groundwater recovery, groundwater storage, water quality improvement and water recycling through the use of Proposition 13 Water Bond funding. Approximately 20 potential groundwater recovery projects were evaluated with a net yield of 95,000 acre-feet per year.

The Port Hueneme Water Agency was formed to develop and operate a brackish water desalting demonstration facility for its member agencies in western Ventura County. Its goals are to improve the quality and reliability of local groundwater supplies and decrease seawater intrusion in the Oxnard Plain. The facility will provide a full-scale demonstration of side-by-side operation of three brackish water desalting technologies: reverse osmosis, nanofiltration, and electrodialysis reversal. The feasibility of using desalting concentrate for wetlands enhancement is also being studied.

Increasingly, the region’s water wholesalers, such as Castaic Lake Water Agency, San Bernardino Valley Metropolitan Water District, Mojave Water Agency (MWA), MWD, and San Diego County Water Authority are acquiring part of their future supplies from water marketing or exchange arrangements, using the CRA and California Aqueduct to convey the water.

An agreement in late 2003 between MWA and MWD calls for the exchange of 75,000 acre-feet of SWP flow from the California Aqueduct. Under the accord, MWA received about 23,000 acre-feet of MWD’s state-authorized flow via the aqueduct at the end of 2003. Additional flow through this agreement will depend on the amount of rain or snowfall available to the SWP. Water will be stored in the high desert’s underground aquifers to help replenish the water table, prevent well-deepening by residents, and meet future needs.

In 2003, the SDCWA and IID consummated the largest water transfer in the history of the United States. This transfer, which eventually will move 200,000 acre-feet of conserved water by farmers in the Imperial Valley to San Diego County, has helped reduce SDCWA’s dependence on MWD and diversified its sources of imported water. The initial term of the agreement is for 45 years; a 30-year extension is possible with the mutual consent of both parties. In addition, SDCWA will gain an additional 77,000 acre-feet of water per year through projects it will undertake to line the All-American and Coachella canals to stop water loses that occur because of seepage. This program has a 110-year term.

The South Coast region has placed an increased emphasis on improving watershed management and protection. Local, state, and federal agencies and nonprofit organizations have invested in several management efforts, including watershed education, monitoring, and wetlands management and protection. There are over 40 entities that are generating new partnerships and coalitions among various stakeholders in attempts to integrate elements of flood hazard mitigation, groundwater and stormwater conservation, management of the quality of stormwater runoff, along with other natural resources, to better manage sources. Following are examples of the region’s watershed programs:

- SAWPA, the largest watershed organizations, is established to protect and enhance the quality and supply of the watershed and protect the environment by implementation of its watershed plan.
- Under the guidance of the Los Angeles County Department of Public Works, watershed management plans are being developed for five coastal watersheds within Los Angeles County. Eleven watershed and sub-watershed plans have been completed with eight pending or proposed

plans underway, making Los Angeles County the most productive county in the state in terms of watershed planning.

- The Hemet/San Jacinto Multipurpose Constructed Wetlands is a collaborative project between the US Bureau of Reclamation and Eastern Municipal Water District. The Wetlands is nearly 60 acres in size and consists of five interconnected marshes. It provides nitrogen removal of secondary-treatment recycled water and habitat for migratory waterfowl, shore birds, and raptors along the Pacific Flyway.
- The San Diego Creek Watershed is operated by the Irvine Ranch Water District. The watershed program helps sustain a restored marsh and treats contaminated urban runoff water from San Diego Creek before it enters into Newport Bay in Orange County.
- The Orange County Water District (OCWD) operates the Prado Basin Wetland in Riverside County. In cooperation with the United States Army Corps of Engineers and the United States Fish and Wildlife Service, OCWD operates 465 acres of constructed freshwater wetlands to reduce the nitrogen concentration of river water.

Looking to the Future

The region’s water agencies generally have solid plans for adapting to changing conditions and meeting future water needs. For example, the 2003 Report on Metropolitan’s Water Supplies states, “Metropolitan has a comprehensive supply plan to provide sufficient supplemental water supplies and to provide a prudent supply reserve over the next 20 years and beyond.” The Santa Ana Watershed Program (SAWPA) has begun a 10-year integrated program to help, among other things, drought-proof the watershed so that it can roll off imported water for up to three years during drought years. Water agencies in the Santa Clarita Valley are engaged in integrated urban water management planning, collaborative data collection, and a new groundwater plan. These and other ongoing planning programs are important to manage changing conditions facing the region. Water conservation programs, water recycling, and groundwater recovery, as well as water marketing and other water supply augmentation responses are being examined and implemented.

Integrated Resource Planning

MWD adopted its Integrated Resource Plan (IRP) in 1996 and recently has updated that plan with the Draft 2004 IRP. The Draft 2004 IRP accomplishes the three objectives of reviewing goals and achievements of the 1996 IRP, identifying changed conditions for water resource development, and updating the resource targets through 2025.

SAWPA recently completed its 2002 Integrated Water Resource Plan. It provides information on water demand and supply planning, water resource plans from member agencies, balancing and integrating available resources, and identifying regional problems and issues and potential long-term solutions.

California's Colorado River Water Use Plan describes how California will reduce its use of river water over time to its allotted 4.4 million acre-feet per year. The first phase of the plan, extending from the present to 2010 or 2015, consists of those actions that are now in some stage of planning and implementation. These programs are intended to reduce California's annual use of Colorado River water to 4.6-4.7 million acre-feet. The second phase consists of actions that have not yet been formulated and quantified. Examples of phase one actions are the San Diego County Water Authority-Imperial Irrigation District transfer of Colorado River water; the lining of parts of the All-American Canal (23 miles), which will conserve 67,000 acre-feet of water each year that will be available for transfer, and the All-American Canal and groundwater banking projects associated with surplus Colorado River water. An example of potential phase two actions is desalting water in Salton Sea tributaries and conveying the treated water to the South Coast Region.

MWD will continue its replenishment services pricing program to encourage local agencies to store imported water in groundwater basins for use during the summer and during drought years. In addition, local agencies in the region are now planning to use water transfers for part of their base supplies, a change from past years when marketing arrangements were viewed as primarily for drought year supplies.

Ocean water desalination is sometimes described as the ultimate solution to Southern California's water supply shortfall. While it has become a more feasible source of supply due to technical advances, its development is restrained by high costs, environmental impacts of brine disposal, and plant siting considerations. State agencies have provided funding for the Desalination Research and Innovation Partnership, which furthered the development of advance reverse osmosis membranes.

MWD and five of its member agencies have planned the development of 126,000 acre-feet of desalinated ocean water. Those member agencies include LADWP, Long Beach Water Department, Municipal Water District of Orange County, West Basin Municipal Water District, and SDCWA. The SDCWA expects desalted ocean water to meet between 6 and 15 percent of the region’s needs by 2020 and is conducting an environmental review for building an ocean water desalination facility on the Encina Power Plant property in Carlsbad. SDCWA also is carrying out feasibility studies of desalination facilities at Camp Pendleton and in the southern county. All three site are located on the coast.

Another future water supply option is management of the San Bernardino Basin as a groundwater storage facility. The Basin has a capacity of about 5.5 million acre- feet. Pursuant to the January 1969 settlement for Western Municipal Water District *et al*. vs. East San Bernardino Valley Municipal Water District *et al.* Superior Court Riverside County Case number 78426, the Western-San Bernardino Watermaster determined that the safe yield of the San Bernardino Basin Area is about 232,000 acre-feet per year. SBVMWD has been working with USGS for many years to develop a groundwater model that will enable the agency to enhance the safe yield of the basin.

Orange County Water District and Orange County Sanitation District are sponsoring the Groundwater Replenishment System. The project will take highly treated wastewater and treat it beyond drinking water standards for groundwater recharge and injection into the seawater barriers along the coast. This project will provide a second and reliable source of water to recharge the Orange County Basin; protect the Basin from further water quality degradation brought on by sea water intrusion; and augment the existing recycled water supply for irrigation and industrial uses.

Existing flood control reservoirs are now being evaluated for their potential to provide some water supply benefits through the modification of the operation of the facilities to enhance groundwater recharge and provide limited year-round storage. The San Bernardino Valley Municipal Water District, for example, has applied to the SWRCB for authorization to store stormwater from the Santa Ana River in a reservoir that could be created by Seven Oaks Dam. LACDPW is completing a study, in cooperation with the Army Corps of Engineers, to reauthorize four Corps flood control facilities in Los Angeles County for the purpose of capturing and safely storing stormwater and then slowly releasing the water to downstream groundwater recharge facilities after storm events.

The Water Augmentation Study is a long-term research project, led by the Los Angeles and San Gabriel Rivers Watershed Council and supported financially by its partners, the Bureau of Reclamation, MWD, LACDPW, LA RWQCB, WRD of Southern California, LADWP, Los Angeles City Sanitation, and the City of Santa Monica. The purpose of the study is to explore the potential for increasing local water supplies and reducing urban runoff pollution by increasing infiltration of stormwater runoff upstream. The project was initiated in January 2000 to assess the impact of runoff-transported pollutants on rivers, coastal water, and beaches; the viability of adding these stormwater resources to local water supplies, and the challenge of capturing stormwater for infiltration, in terms of both groundwater quality and quantity.

Two Examples of ongoing ecosystem restoration projects:

The Matilija Dam Ecosystem Restoration Feasibility Study is evaluating alternatives and will recommend a preferred method for removing the 160-foot high dam, including stored sediment, to restore the Ventura River ecosystem.

The Santa Ana River Trail and Parkway Project includes planning of recreational uses that showcase the river and provide a place for people to enjoy this important resource.

The Mojave Water Agency (MWA) has embarked on a Regional Water Management Plan (RWMP) Update that will provide a regional roadmap for managing water resources and ensuring a reliable water supply for the future of the MWA desert region. While MWA relies predominately on groundwater, it also receives water from the California Aqueduct as one of 29 SWP Contractors. The RWMP Update will address population growth, water demand projections, stakeholder needs and issues, facilities needed to replenish groundwater supplies, and revenue alternatives.

In 2000, DWR, in cooperation with the U. S. Bureau of Reclamation and 10 Southern California water and wastewater agencies, undertook the Southern California Water Recycling Projects Initiative to continue the work begun during the Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS). The Initiative is a multi-year planning study that evaluates the feasibility of a regional water-recycling plan and assists local water and wastewater agencies in final planning and environmental documentation leading to implementation of projects identified in the SCCWRRS. The Initiative is funded on a 50/50 percent cost-sharing basis among the 12 agencies. The Initiative identified short-term projects that could add approximately 378,000 acre-feet of recycled water for regional use. The fifteen short-term projects identified were as follows: Calleguas, East San Gabriel, West Basin, Central Basin, Noth Orange County, Central Orange County, Upper Oso, San Juan, Encina, San Pasqual Valley, North City, South Bay, Chino Basin, San Bernardino, and Eastern.

As part of a regional strategy to improve water supply reliability, several agreements with water districts in the Central Valley are providing groundwater storage for the South Coast Region:

- Semitropic Water Banking and Exchange Program. This program allows storage of up to 350,000 acre-feet in the groundwater basin underlying the Semitropic Water Storage District in Kern County.
- Arvin-Edison Water Storage Program. MWD and the Arvin-Edison Water Storage District have developed a program that allows Metropolitan to store water in the groundwater basin in the Water Storage District’s service area in Kern County. Over the next 25 to 30 years, this groundwater storage program will provide average dry-year withdrawals of about 70,000 acre-feet annually.

- Kern-Delta Storage Program. This 25-year program will allow storage of up to 250,000 acre-feet of available State Water Project supplies.

Other potential management strategies includes interstate groundwater banking in Arizona, drought year land fallowing programs, lining parts of the All-American and Coachella Canals, and agricultural water conservation beyond EWMP implementation. In addition, South Coast Region water agencies are storing discounted winter-imported water in groundwater basins and increasing their groundwater use during the summer and during drought years.

The Calleguas Municipal Water District operates a conjunctive use program in the Las Posas Groundwater Basin of Ventura County. Identified as the Las Posas Basin Aquifer Storage and Recovery Project, it is designed to store a maximum of 300,000 acre-feet of water supplies that can be used during short-term and long-term water supply shortages. The project calls for the construction of 30 dual-purpose wells that will be used for both injection and production. Pipelines will be constructed to connect the wells with CMWD facilities as far away as the Cities of Simi Valley and Thousand Oaks. The source of water supplies would be the State Water Project. The Project will be phased into operation with full operation anticipated by 2010. To date, 18 wells have been constructed and approximately 50,000 acre-feet of water is in storage.

To improve the reliability of its potable water supplies during droughts, the Western Municipal Water District is moving forward with plans to operate a conjunctive use program in groundwater basins in western San Bernardino and Riverside Counties. The project, the Riverside-Corona Feeder, calls for the recharge of water supplies during above-average precipitation years into the groundwater basins in San Bernardino Valley and pumping those supplies during drought years. Sources of water for the recharging operations would be local surface runoff, including releases from the Seven Oaks Reservoir near the community of Mentone in San Bernardino County and the State Water Project. Recipients of the stored groundwater supplies are Cities of Corona and Riverside and the Elsinore Valley Water District. When complete, 20 wells and 28 miles of pipeline would have been constructed. Approximately 40,000 acre-feet of groundwater supplies could be moved by the project.

Most of the projects described above are designed to improve water quality as the way to increase water supply. These include watershed activities, such as the Water Augmentation Study, groundwater desalination, use of highly treated recycled water by the Orange County Water District, reduction of sewage spills and stormwater runoff through water conservation, and surface and groundwater storage project that implement blending and treatment strategies to reduce disinfection byproducts and other regulated and unregulated contaminants in treated drinking water supplies.

In addition, MWD has committed to retrofitting all five of its water treatment plants to use ozone; adding fluoride to treated drinking water supplies; implementing a recreation policy for Diamond Valley Lake that protects drinking water quality; supporting salinity reduction projects in the region; and outside the region helping preserve and enhance the Sacramento River Watershed, which is an important source of water for the State Water Project system.

Key Elements of Colorado River Quantification Settlement Agreement

The Colorado River Quantification Settlement Agreement will have the following effects:

- Have California adopt specific, incremental steps to gradually reduce its use of Colorado River water over the next 14 years to its basic annual allotment of 4.4 million acre feet.
- Provide Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming with certainty on use of the river, allowing them to take their full allotments to meet future water needs.
- Restore California's and Nevada's privileges to draw extra water from the Colorado River to meet the needs of urban Los Angeles and Las Vegas.
- Transfer as much as 30 million acre-feet of water from farms to cities in Southern California over the life of the agreement.
- Settle a lawsuit between the Imperial Irrigation District and the U.S. Department of Interior (DOI), in which DOI had accused the farming region of wasting water.
- Launch an ambitious plan to reduce Salton Sea salinity, which receives agricultural waste water from Imperial Valley farms, and enhance the Sea and adjacent wetlands for migratory birds.
- Provide for $163 million to offset the environmental impacts of the water transfer in the arid Imperial Valley and help fund the cost of restoring the Salton Sea.
- Fund a $200 million project to line the earthen All-American Canal, which delivers Colorado River water to the Imperial Valley, with concrete. The SDCWA will fund the project and receive 77,000 acre-feet of the water that is conserved.
- Quantify for the first time the total Colorado River allotments for water districts within California.

Water Portfolios for Water Years 1998, 2000 and 2001

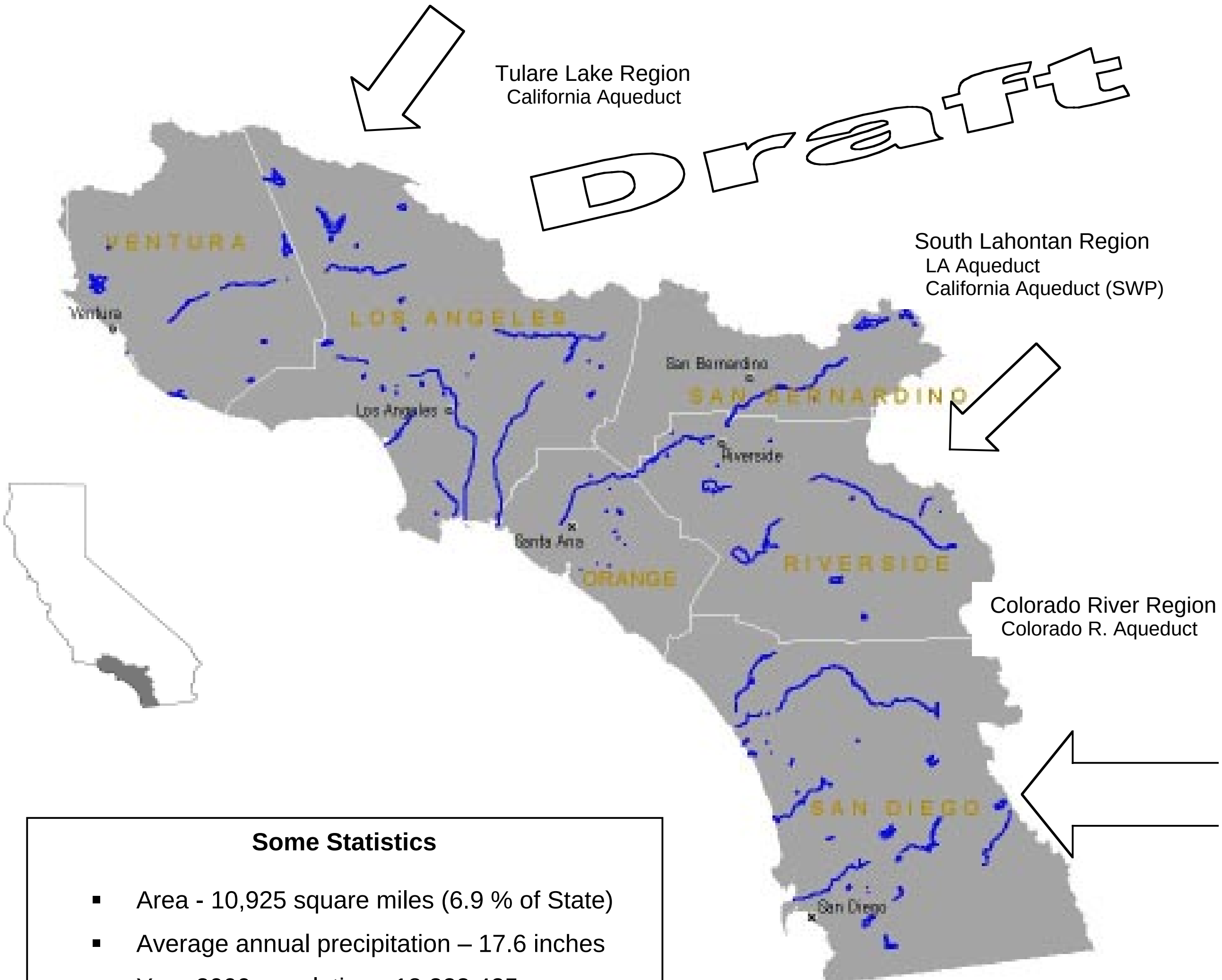
Hydrologic conditions for water years 1998 and 2000 apparently impacted the water supply and water use characteristics for the South Coast Hydrologic Region. In WY 1998, rainfall totals ranged from 170 percent of average in San Diego County to more than 250 percent of average in Ventura County with more than 50 percent of the annual precipitation in January and February. In comparison, during WY 2000 rainfall totals ranged from 60 percent of average in San Diego County to more than 100 percent of average in Ventura County.

In contrast, precipitation amounts for the region for WY 2000 were actually about average to moderately below average. Rainfall deficits increased from north to south.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- Annual Progress Report to the California State Legislature, February 2004, MWD
- Annual Report of the Santa Clarita Valley Water Purveyors
- Correspondence with watershed and water wholesale and retail delivery agencies.

Figure 5-1
South Coast Hydrologic Region



Some Statistics

- Area - 10,925 square miles (6.9 % of State)
- Average annual precipitation – 17.6 inches
- Year 2000 population - 18,223,425
- 2030 projected population –
- Total reservoir storage capacity - 3,059 TAF
- 2000 irrigated agriculture - 253,800 acres

Table 5-1
South Coast Hydrologic Region Water Balance Summary – TAF

(See Water Portfolio section for details)	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	20,873	7,522	9,327
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	1,080	1,296	1,261
Imports from Other Regions	1,137	1,593	1,338
Total	**23,090**	**10,411**	**11,926**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	1,613	1,864	1,744
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	0	0	0
Statutory Required Outflow to Salt Sink	0	0	0
Additional Outflow to Salt Sink	1,687	2,022	1,828
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	20,650	7,924	9,358
Total	**23,950**	**11,810**	**12,930**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	372	128	332
Change in Groundwater Storage **	-1,232	-1,527	-1,336
Total	**-860**	**-1,399**	**-1,004**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	4,204	5,052	4,801

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

****Footnote for change in Groundwater Storage**

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 5-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	South Coast 1998 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	South Coast 2000 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	South Coast 2001 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
nputs:														
1	Colorado River Deliveries		1,081.3				1,296.0				1,202.0			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	20,873.0				7,522.1				9,327.0				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		292.1				211.4				217.1			PSA/DAU
10	Local Imports		401.9				273.1				252.5			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		4.2				0.6				0.7			PSA/DAU
13	State Water Project Deliveries		690.2				1,298.9				1,056.0			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		3.5				3.5				3.5			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		211.6				182.8				188.7			PSA/DAU
c	Recycled Water - Groundwater		2.1				37.1				36.3			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		319.8				386.7				415.4			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		92.8				114.8				92.6			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		-				-				-			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		287.7				37.8				111.7			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	1,380.6				1,515.5				1,643.3				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	711.4				824.7				829.2				PSA/DAU
29	Groundwater Extractions - Unadjudicated	592.8				696.2				627.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	1,752.5				1,643.3				1,975.6				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				18.5				18.5				17.9	REGION
b	Evaporation from Reservoirs				149.1				164.2				160.8	REGION
36	Ag Effective Precipitation on Irrigated Lands		39.0				-				-			REGION
37	Agricultural Use		699.9	607.1	616.6		911.6	796.8	796.8		758.4	665.8	665.9	PSA/DAU
38	Wetlands Use		31.2	31.2	31.2		38.1	38.1	38.1		37.2	37.2	37.2	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		976.8				1,249.0				1,197.1			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		659.4				760.8				677.8			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		591.5				541.3				503.2			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		104.6				142.5				163.3			PSA/DAU
40	Urban Commercial Use		694.8				918.6				909.8			PSA/DAU
41	Urban Industrial Use		182.8				210.2				209.4			PSA/DAU
42	Urban Large Landscape		166.6				241.0				176.8			PSA/DAU
43	Urban Energy Production		39.8				39.8				39.8			PSA/DAU
44	Instream Flow		3.5	-	-		3.5	-	-		3.5	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		284.2	-	-		34.3	-	-		108.2	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				500.8				646.2				540.7	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				31.2				38.1				37.2	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				930.6				1,144.3				1,017.9	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				11.6				15.1				12.5	PSA/DAU
50	Urban Waste Water Produced	1,798.9				2,162.1				2,036.3				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				343.9				374.7				359.8	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				-				-				-	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				104.2				135.5				112.7	PSA/DAU
b	Return Flows to Salt Sink - Urban				1,972.5				2,352.1				2,237.0	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				-				-				-	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	2,575.3				3,141.1				2,763.0				REGION
56	Regional Exports	0.0				0.0				0.0				REGION
59	Groundwater Net Change in Storage	-1,211.4				-1,406.1				-1,364.5				REGION
60	Surface Water Net Change in Storage	371.9				127.8				332.3				REGION
61	Surface Water Total Available Storage	2,112.7				3,058.8				3,058.8				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

Table 5-3
South Coast Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	166.6			241.0			176.8		
Commercial	694.8			918.6			909.8		
Industrial	182.8			210.2			209.4		
Energy Production	39.8			39.8			39.8		
Residential - Interior	1,568.3			1,790.3			1,700.3		
Residential - Exterior	764.0			903.3			841.1		
Evapotranspiration of Applied Water		930.6	930.6		1,144.3	1,144.3		1,017.9	1,017.9
Irrecoverable Losses		501.6	501.6		590.4	590.4		575.3	575.3
Outflow		1,654.8	1,654.8		1,981.8	1,981.8		1,868.5	1,868.5
Conveyance Losses - Applied Water	160.0			154.6			153.0		
Conveyance Losses - Evaporation		160.0	160.0		154.6	154.6		153.0	153.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**3,576.3**	**3,247.0**	**3,247.0**	**4,257.8**	**3,871.1**	**3,871.1**	**4,030.2**	**3,614.7**	**3,614.7**
Agriculture									
On-Farm Applied Water	699.9			911.6			758.4		
Evapotranspiration of Applied Water		500.8	500.8		646.2	646.2		540.7	540.7
Irrecoverable Losses		11.6	11.6		15.1	15.1		12.5	12.5
Outflow		104.2	104.2		135.5	135.5		112.7	112.7
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**699.9**	**616.6**	**616.6**	**911.6**	**796.8**	**796.8**	**758.4**	**665.9**	**665.9**
Environmental									
Instream									
Applied Water	3.5			3.5			3.5		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	284.2			34.3			108.2		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	31.2			38.1			37.2		
Evapotranspiration of Applied Water		31.2	31.2		38.1	38.1		37.2	37.2
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	31.2	31.2	31.2	38.1	38.1	38.1	37.2	37.2	37.2
Total Environmental Use	**318.9**	**31.2**	**31.2**	**75.9**	**38.1**	**38.1**	**148.9**	**37.2**	**37.2**
TOTAL USE AND LOSSES	**4,595.1**	**3,894.8**	**3,894.8**	**5,245.3**	**4,706.0**	**4,706.0**	**4,937.5**	**4,317.8**	**4,317.8**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	292.1	292.1	292.1	211.4	211.4	211.4	217.1	217.1	217.1
Local Imported Deliveries	401.9	401.9	401.9	273.1	273.1	273.1	252.5	252.5	252.5
Colorado River Deliveries	1,081.3	1,081.3	1,081.3	1,296.0	1,296.0	1,296.0	1,202.0	1,202.0	1,202.0
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	4.2	4.2	4.2	0.6	0.6	0.6	0.7	0.7	0.7
SWP Deliveries	690.2	690.2	690.2	1,298.9	1,298.9	1,298.9	1,056.0	1,056.0	1,056.0
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	1,211.4	1,211.4	1,211.4	1,406.1	1,406.1	1,406.1	1,364.5	1,364.5	1,364.5
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	92.8			114.8			92.6		
Reuse/Recycle									
Reuse Surface Water	607.5			424.5			527.1		
Recycled Water	213.7	213.7	213.7	219.9	219.9	219.9	225.0	225.0	225.0
TOTAL SUPPLIES	**4,595.1**	**3,894.8**	**3,894.8**	**5,245.3**	**4,706.0**	**4,706.0**	**4,937.5**	**4,317.8**	**4,317.8**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 5-2
South Coast Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

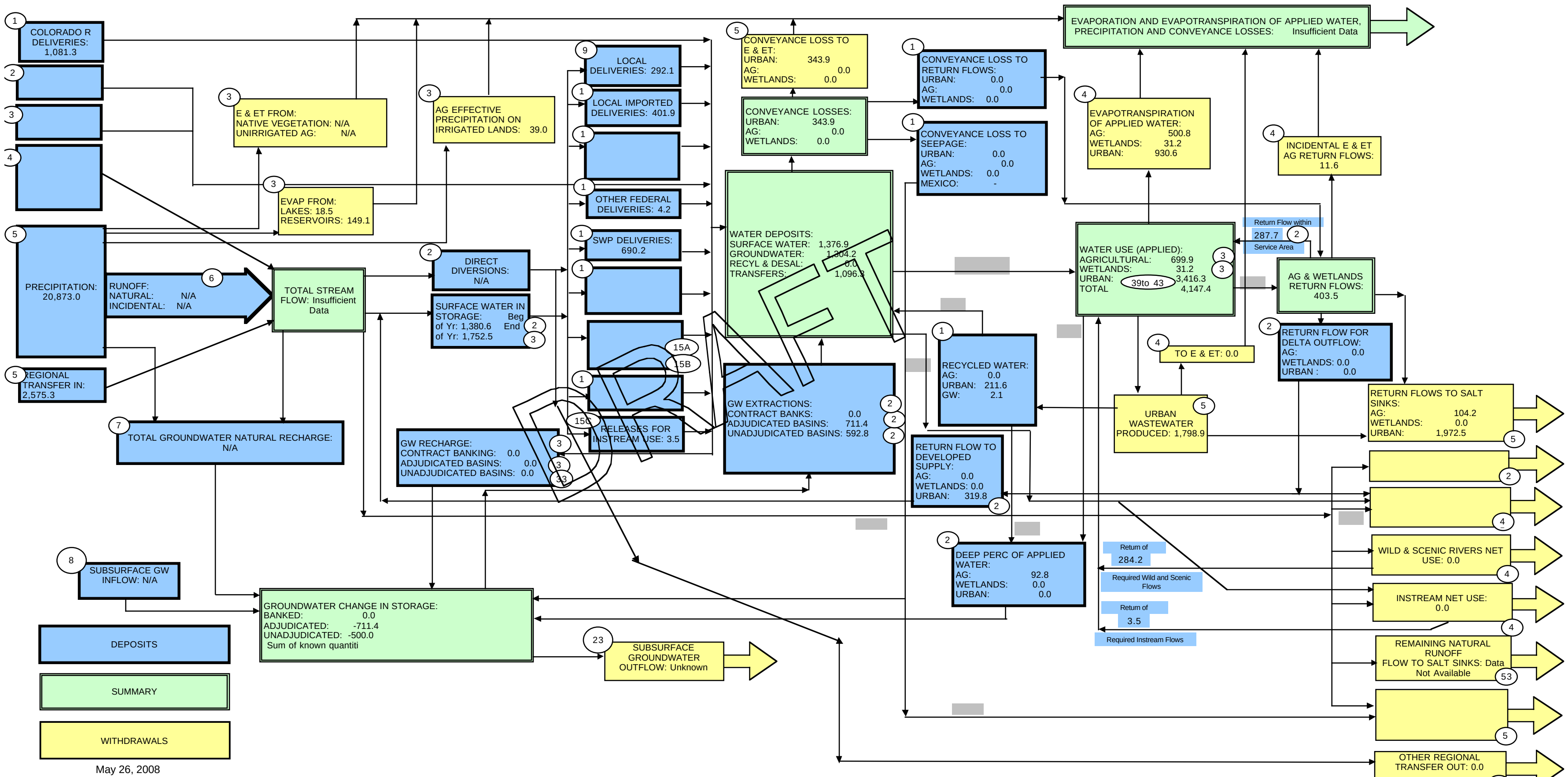
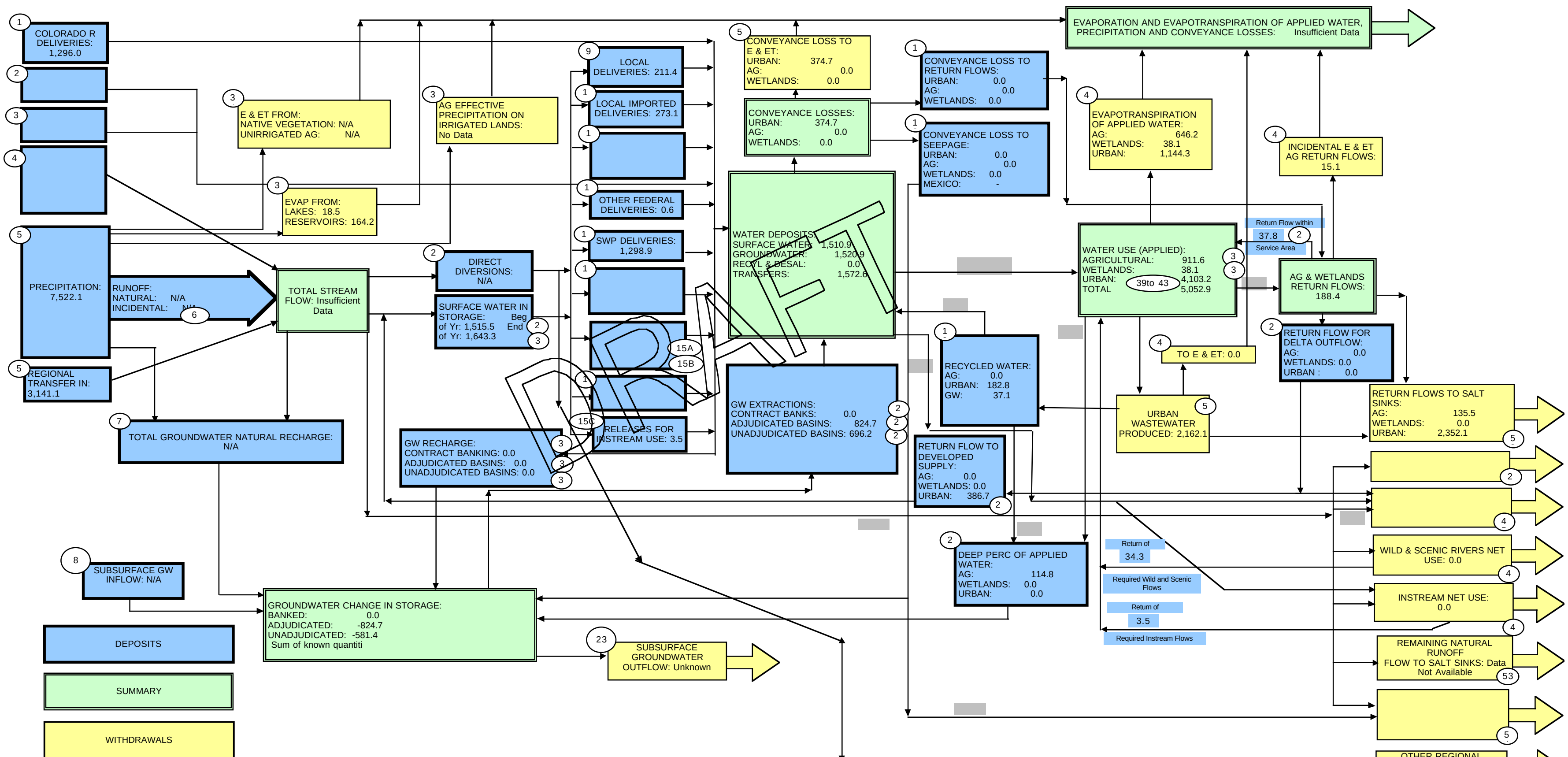
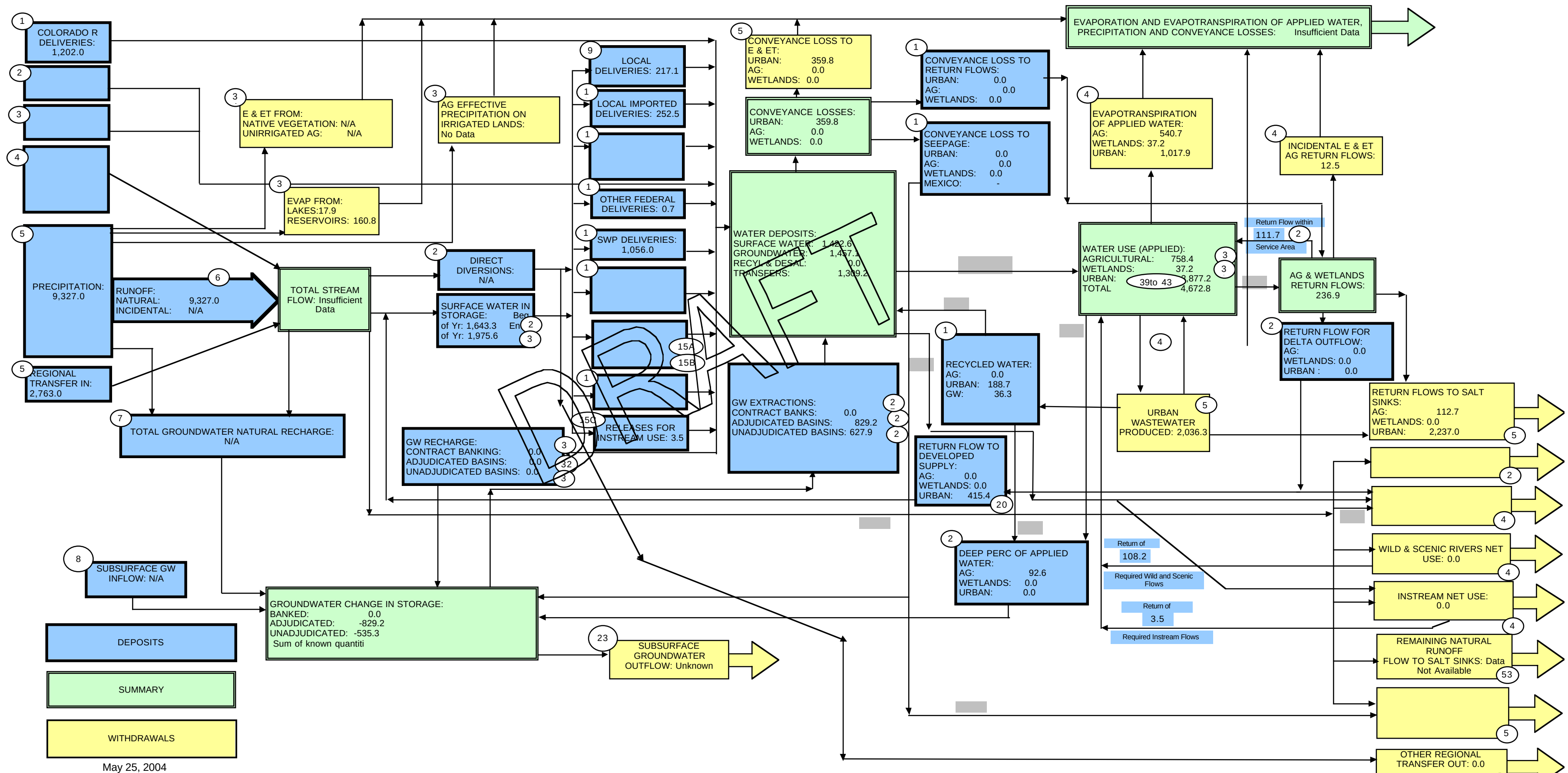


Figure 5-3
South Coast Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)



May 26, 2008

Figure 5-4
South Coast Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 6. Sacramento River Hydrologic Region

Setting

The Sacramento River hydrologic region includes the entire drainage area of the State's largest river and its tributaries, extending from the Oregon border downstream to the Sacramento – San Joaquin Delta. The region covers 27,246 square miles including all or a portion of twenty predominately rural northern California counties, and extends from the crest of the Sierra Nevada in the east to the summit of the Coast Range in the west. The northernmost area, mainly high desert plateau, is characterized by cold, snowy winters with only moderate rainfall, and hot, dry summers. The mountainous parts in the north and east typically have cold, wet winters with large amounts of snow providing runoff for summer water supplies. The Sacramento valley floor has mild winters with less precipitation and hot dry summers. Overall annual precipitation within the region generally increases as you move from south to north and west to east. The heavy snow and rain that falls within this region contributes to the overall water supply for the entire state.

The many rivers and streams that are tributary to the Sacramento River provide important riparian habitat that is critical for many aquatic and terrestrial species including the Spring-run Chinook salmon (Oncorhynchus tshawytscha), Winter-run Chinook salmon (Oncorhynchus tshawytscha) and Central Valley steelhead (oncorhynchus mykiss). This region is the only known area for the Winter-run Chinook. The valley floor region section adjoining the river, provide some of the most important wintering areas along the Pacific Flyway for many varieties of waterfowl. The region also houses several wetland and waterfowl preserves that provide nesting and migration areas for threatened avian species including the bald eagle and Swainson's hawk and numerous species of neotropical birds. All of these valuable resources are vital components of the ecosystem and contribute to the ecological health of the entire state.

Agriculture is the region's largest industry, contributing a wide variety of crops including rice, grain, tomatoes, field crops, fruits and nuts. Crop statistics show that irrigated agricultural acreage in the region peaked during the 1980s and has since declined with a little over 2 million acres irrigated in year 2000. Excess applied irrigation water generally returns to the supply system through drainage canals, or recharges groundwater. Basin efficiency is usually very good because downstream users recycle return flows for their own use. In some places, return flows are the only water source for downstream agricultural users.

Most urban development has been along the main highway corridors. A few of the larger cities in the region take the majority share of their water supplies from the larger rivers, but throughout most of the region, groundwater is the principal source of water for urban and rural dwellers. The Sacramento Valley is recognized as one of the foremost groundwater basins in the state. In the rural mountain areas of the region, domestic supplies come almost entirely from groundwater.

The Sacramento River Hydrologic Region also encompasses all or a portion of six of the state's eighteen national forests. Lassen, Mendocino, Modoc, Plumas, Shasta-Trinity and Tahoe Basin National Forests are contained or contiguous to the region and contribute to the dynamics of its vast landscape. These federally-owned lands are each managed with specific goals for fish and wildlife such as the recovery of the spotted owl or the Chinook salmon, as well as for hydro-power and sustainable timber harvest. Such diverse goals often call for creative management strategies. Total acreage for Nation Forest properties within the region is ________.

Population

The population of the Sacramento River hydrologic region was approximately 2,593,000 in year 2000, which represents about 14 percent of California's total population. Referencing the Table Sacramento River Region Population Density By County, geographically, the largest county within the region is Siskiyou (6,287 square miles), with a current population of 44,650 or about 7 persons per square mile. Sacramento County is the most populated county within the region, with a density of 1,273 persons per square mile. When looking at the map of the region on page 3 of this report, it should be noted that both of these counties are only partially within the region. However, these statistics are useful in portraying the environment of the region, which (except for Sacramento) is predominately rural in nature with low population ratios per square mile.

Although population numbers are less dense than other regions of the state with the current total population for this vast geographic area are a little over 2.5 million persons, it is anticipated that population numbers will increase to over 4.3 million by the year 2030. This growth will have a significant impact on shaping the natural resources of the region. Population per square mile decreases as you move further north into the region, which contains immense areas of agriculture and timberlands, both private and public owned.

Future land use planning and decisions, at both the state and local level, will need to consider the changing complexion of the region, as well how to best utilize and preserve the vast open spaces and abundant natural resources still available within the region.

Sacramento River Region Population Density By County

COUNTY	POPULATION	SQUARE MILES	PERSONS PER SQUARE MILE
Butte	206,800	1639	126
Colusa	19,300	1151	17
El Dorado	163,900	1711	96
Glenn	26,850	1315	20
*Lake	60,200	1258	48
*Lassen	34,350	4557	8
*Modoc	9,450	3944	2
*Napa	128,100	754	170
Nevada	94,200	958	98
Placer	261,500	1404	186
Plumas	21,000	2554	8
Sacramento	1,267,800	996	1,273
Shasta	168,600	3785	45
*Sierra	3,550	953	4
*Siskiyou	44,650	6287	7
Sutter	81,000	603	134
Tehama	56,500	2951	19
*Trinity	13,050	3179	4
Yolo	174,500	1013	172
Yuba	61,300	631	97
* represents counties only partially covered within the region			

California Dept. of Finance (July, 2001 Estimated)

Water Supply and Usage

Because of the weather patterns that produce a high level of precipitation within the region, major water supplies from within the region are provided through the development of surface storage reservoirs and from direct groundwater pumping, which historically has recharged through the winter months. Major reservoirs in the region provide water supply, recreation, power, environmental, and flood control benefits. The Central Valley Project (CVP) is the largest water project in the state, and includes Shasta Lake, Whiskeytown Lake, Keswick Reservoir and Folsom Reservoir within this region. A large portion of the water supplied by CVP facilities is delivered for agriculture purposes, both within this region and as water exports to other regions. USBR's Solano Project provides urban and agricultural water supply to parts of the Sacramento River Region and parts of the San Francisco Bay Region. The major water supply facilities of the State Water Project (SWP) are located along the Feather River basin within this region, consisting of Oroville Reservoir, Thermalito Afterbay, Lake Davis and Frenchman Reservoir. SWP water supplies serve both urban and agricultural uses in this region and are exported southward to other drier regions of the State. A large amount of stored water from both CVP and SWP reservoirs is released downstream to maintain environmental water quality standards in the Sacramento – San Joaquin Delta. Such storage releases are critical in the summer and fall months, to prevent ocean salt water from penetrating eastward into the Delta during high tidal cycles.

There are several other, smaller reservoirs that add to the overall surface water supply. In total, the region has 43 reservoirs, with a combined capacity of almost 16 million acre feet (maf). Major reservoirs within the region provide not only water supply, but also are the source of recreational opportunities, power generation, and other environmental and flood control benefits. In addition, the region has a network of creeks and rivers that convey water for use throughout the region and also provide nesting and rearing grounds for major fish and wildlife species of concern.

Water usage in the Sacramento River Region is predominantly for agricultural production with over 2.1 million irrigated acres recorded in 2000. Agricultural products include a variety of crops such as rice and other grains, tomatoes, field crops, fruits and nuts. There is also a substantial number of acres held in rangeland for livestock management. (Need % and rangeland numbers here) Much of the economy of the region relies on agricultural water supplies, which are diverted and distributed through extensive systems of diversion canals and drains. Basinwide water use efficiency is generally high, because many return flows from fields are captured by drainage systems and then re-supplied to other fields downstream. In some places, these return flows are the primary water source for other downstream agricultural users. In addition, excess applied irrigation water can return to the supply system by percolating downwards as groundwater recharge.

The larger urban areas in the region have historically developed near the major rivers, such that surface water diversions are a key component of municipal water supplies. However, the Sacramento Valley is also recognized as having one of the foremost groundwater basins in the state. The availability of abundant groundwater supplies under the valley floor regions has allowed urban areas to expand delivery capabilities by including the use of groundwater. In some areas, groundwater has become the principle source of water supply for urban as well as rural domestic uses.

In-stream flows, refuges and wildlife areas are the principal environmental use of water within the region. With the federal and state listing of the Spring-run Chinook salmon, Winter-run Chinook and Central Valley steelhead, much attention has been given to the recovery of these species and their related habitat.

Tributaries to the Sacramento River, as well as the main stem itself, have been the focus of a number of ecosystem-related projects designed to increase the amount of environmental water use for habitat and species restoration.

In addition, the Sacramento Valley serves as a breeding and resting ground along the Pacific Flyway. Therefore, in more recent years, duck and other waterfowl habitat development in the valley section by duck clubs, non-profit groups and natural resource agencies have resulted in an increase in the use of environmental water in an attempt to increase the numbers of waterfowl species residing within or using the region. Certain agricultural practices are known to benefit many species of wildlife. The programs that provide the most benefits are the rice straw decomposition program and the use of agricultural return flow to refuges and duck clubs, which are designed to improve air and water quality in the valley. As a result of these programs, and other resource management activities, the Sacramento River Region contains the largest and most extensive wetlands in the state. The Sacramento River Region has a number of acres in both private and public ownership dedicated to managed wetlands. For example, in the northeastern mountain counties, associated with the Pit River system, (such as the Big Valley and Alturas area), there are approximately 14,000 acres of managed wetlands. Further south, moving into the Sacramento Valley section, there are 16,987 acres in federal ownership; 11,987 acres of state lands; and 28,642 acres in private ownership currently managed as wetlands.

With the listing of the Winter-run Chinook, Spring-run Chinook salmon and Central Valley steelhead, much of the water diverted out of the Sacramento River waterways for agricultural use, environmental uses and refuge water supplies passes through state-of-the-art fish screens. These fish screens minimize take of the species when water is diverted from the river, and also increases system flexibility, allowing year-long diversion of water for agricultural purposes.

Current Situation

Table 6-1 presents a Water Supply Balance for this hydrologic region for years 1998 (wet), 2000 (average rainfall) and year 2001 (a dry year). The total sources of all water supplies to the region are tabulated in the top portion of Table 6-1, the major uses of all water are shown in the middle section, and estimated interaction with groundwater storage is shown at the bottom of the table. Using year 2000 as an example, a significant portion of the precipitation (57,106 TAF) is used by native vegetation (forests), evaporation, unregulated runoff and percolation to groundwater (tabulated as 30,535 TAF). Statutory Required outflows to maintain Delta water quality requirements (SWRCB Decision 1630) are the next largest component of water use (11,415 TAF), followed by water exports to other regions (6,240 TAF) and the consumptive use of applied water within the Sacramento River region (5,538 TAF).
Table 6-3 provides more specific information about the developed or dedicated component of water supplies for agricultural, urban and environmental purposes, as assembled from actual data for years 1998, 2000 and 2001. This table provides more specific information regarding the distribution of developed water, including a high amount of agricultural usage. Note that the Environmental water use component of this Table includes the amount required to maintain Delta outflow standards, which amounts to more that half of the tabulated environmental water usage.

State of the Region

The 30 percent of the region’s lands that are irrigated with groundwater generally enjoy a reliable supply as do those urban areas that depend on groundwater as all or part of their supply. However, groundwater development in fractured rock sources are highly variable in terms of water quantity and water quality and are are an uncertain source for large-scale residential development. Groundwater quality in the Sacramento River Region is generally good, but there are areas with local groundwater problems. Natural water quality impairments occur at the north end of the Sacramento Valley where wells typically have high TDS content. Other local natural impairments are moderate levels of hydrogen sulfide in groundwater in the volcanic and geothermal areas in the western portion of the region.

In the more rural portions of this region, small, widely dispersed populations translate into high per capita costs for municipal water system maintenance and improvements. Historic development pattern of small geographically dispersed population centers can constrain the ability to interconnect individual water systems or to develop centralized sources of good quality municipal water supplies because major capital improvement projects become more expensive.

Exports from the Sacramento Valley are a concern for some water interest groups within the region, many of which are fearful of losing this resource considered a key component to future economic growth. Although is seems that there is an abundance of supply in this hydrologic region, infrastructure within the foothill communities is limited and water development has historically been constructed to meet the needs of the downstream urban and agricultural users, resulting in some outlying and foothill areas being subject to supply shortages in many years. The unique water problems of the foothill regions are described in more detail in Chapter 12 on the Mountain Counties regions. Urban areas in the central part of this region generally have sufficient supplies to survive dry periods with periodic cutbacks. However, as future population growth increases within the region, the competition for high quality water municipal water supplies will also increase.

Many north valley water users are also concerned that in the future their surface water rights may become further curtailed and more groundwater will be needed for irrigation as well as for urban use. In this light, they are apprehensive about new proposals involving the export of surface and groundwater supplies to other locations, unless proper planning is completed to provide assurances for retaining the supplies necessary to meet future agricultural, urban and environmental needs at the local level.

It is anticipated that such changes in surface water allocation within the region will probably occur with negotiations for renewal of CVP contracts, increased environmental restoration, expanded conjunctive use of surface and ground water, and various proposals and designs for water transfers. Cumulatively, these changes could stimulate a substantial increase in groundwater use within the region. In addition groundwater development will most likely be targeted to meet a significant share of the moderately increasing water demands of the region. In response to this phenomenon, some local governments within the region are investigating imposing strict groundwater regulations for new development to assure adequate supply for future needs.

The potential for developing new supplies from groundwater is most favorable in the northern portion of the Sacramento Valley. The southern portion is already experiencing localized groundwater supply and quality problems, such as in the Sacramento area. Although substantial groundwater can potentially be identified in the Sacramento Valley, there is still a great deal of research that needs to be completed to evaluate the quantity and quality of these supplies. In the event that additional groundwater supplies are identified and confirmed through scientific methods, much of the existing groundwater infrastructure would have to be replaced or modified to utilize the resource to its fullest prospective. Moreover, additional groundwater utilization in the Sacramento Valley has the potential to decrease accretions or deplete river and tributary flow, which may have negative environmental impacts.

Competition for use of the groundwater resource is expected to continue as population increases occur, and the potential also exists for an increased number of water transfer programs in the future. Water transfers, especially those contracts with a groundwater substitution component, need to be evaluated for their cumulative effects, because the overall effect could contribute to greater usage of the groundwater resources within the region that may negatively impact local water users.

In recent years, requirements for managing threatened and endangered species are influencing management of the region's water supplies. The salmon and steelhead fishery in the upper Sacramento River has declined greatly over past decades, resulting in many programs and projects for fishery restoration. Along the Sacramento River, factors that contribute to this problem include: unsuitably warm water temperatures, toxic heavy metals from acid mine drainage, pesticides and fertilizer runoff, degraded spawning gravels, obstructions to fish migration, and prior loss of riparian habitat due to growth or noxious weed encroachment. It should be noted, however, that some riparian habitats are now being restored due to projects funded by the agencies associated with CBDA, which will be discussed later in this chapter.

In summary, the majority of the region does enjoy abundant groundwater and surface water supplies for all beneficial uses within the region. However, precautions should be taken with land use changes that may utilize a greater amount of the natural resources because the majority of the area is just beginning to understand its groundwater resources and how they, combined with surface water supplies, can be used in the most efficient manner.

Challenges

Water Reallocation and Transfers

During extended periods of drought, water districts within the Sacramento River Region that are reliant on surface water supplies may be faced with insufficient water supplies, due to surface water allocation cutbacks imposed by their CVP and SWP water contracts. Although SWP supplies and CVP supplies may differ in their water cutback procedures, both may impose reductions to deliveries in an extended drought. Such reductions could eventually force water users to choose between using groundwater to replace the reduced surface supplies, or taking valuable agricultural acreage out of production. The additional use of groundwater supplies by a greater number of water users during drought periods may result in adverse impacts to the groundwater resource, which has the potential to negatively impact users that are totally dependent on groundwater supplies.

With a growing demand for high quality water throughout the state, water transfers are being evaluated more closely as a means to move water out of the Sacramento River Region to other parts of the state. In response, several counties within the region have passed ordinances that regulate or impede water transfers that transfer water outside of their county, primarily if the program has a groundwater component. In some counties, for instance transferees are required to mitigate for third-party impacts associated with this type of water transfer and transfers require a permit approved by the Board of Supervisors or their designee. In other counties, transferring groundwater outside of the county is currently prohibited.

Water Quality

With regard to drinking water quality, the Sacramento River Region currently enjoys predominately high quality water supplies. Therefore, the primary interest within the region is in maintaining the current high quality supply through monitoring and assessment intended to make high quality supplies available locally. Pesticide management and agricultural water discharge has recently come into the limelight with the Central Valley Regional Water Quality Control Board’s decision to eliminate waivers associated with agricultural discharge. Groups within the region are forming partnerships to address this issue through a watershed approach as adopted by the Regional Board and affirmed by the State Water Resources Control Board. Stakeholders within the region are working to find a solution that encompasses the protection of public health, meets current and future water quality regulations, and allows for a sustainable agricultural economy.

Accomplishments

The goals and objectives of the CBDA program play a prominent role in regional efforts to improve water supply reliability, water quality and ecosystem restoration. Current activities and accomplishments are summarized in the following sections.

Water Supply Reliability

Past concerns with potential groundwater exports have spurred numerous counties to enact groundwater ordinances to regulate groundwater extraction when groundwater is intended for export outside the county. In addition, some counties are also involved in extensive cataloging and inventory projects to determine the extent of their water resources and unmet needs of the region to ensure that current and future needs are met locally prior to water exports.

In addition, regional representatives are working in conjunction with CBDA to conduct an extensive reevaluation of additional off-stream surface storage reservoirs within this region designed to store excess water during high flow events and thereby, help alleviate pressure for water exports from the region. Water use efficiencies within the region could provide benefits to other regions of the state if the storage and conveyance capacity existed to hold and transport water when it is needed. This process, commonly known as the North of Delta Off-Stream Storage (NODOS) is evaluating previously identified sites for their suitability in this type of project. Specifically, the Department of Water Resources is currently conducting an environmental evaluation of the Antelope Valley on the West side of the Sacramento River, near Maxwell for the construction of the off-stream of storage facility known as Sites Reservoir.

Water Use Efficiency

Water use efficiency in the Sacramento Valley is included in a comprehensive and integrated program being pursued by the diverters in the region. Most water losses within the region are “recoverable” which means that they return to rivers and streams where they can be re-used by downstream diverters. Because of this, there is limited local incentive to improve water use efficiency other than decreasing costs. CBDA’s Water Use Efficiency program uses grant funding to provide incentives to water users in the Sacramento Valley to develop system improvements that will make water available for uses that provide statewide benefits. These benefits include improving endangered species habitat and improving overall water quality throughout the system by improving source water quality.

As one agency involved in Water Use Efficiency Program’s, CALFED has provided the following through Year 3 of the California Bay Delta Program:

- Partnerships forged for groundwater planning with local agencies in six areas.
- Work initiated on 22 groundwater management and groundwater storage projects.
- Progress made on studies for potential north-of-Delta off-stream storage and Shasta Dam enlargement. The proposed projects are among five surface storage options being studied to increase storage capacity and provide flexibility to the state's water system.
- $11 million in grants awarded for agricultural and urban water use efficiency programs.
- Key achievements made on streamlining water transfers and facilitating transfer agreements that protect local water users, economies and ecosystems.

Drinking Water Quality

Both groundwater and surface water supplies within the Sacramento River Region are of high quality, but there are some emerging areas with local groundwater problems. Natural water quality impairments occur at the north end of the Sacramento Valley where wells typically have high Total Dissolved Solids (TDS) content. Other local natural impairments are moderate levels of hydrogen sulfide in groundwater in the volcanic and geothermal areas in the western portion of the region. In the Sierra foothills there is potential for encountering uranium and radon-bearing rock or sulfide mineral deposits containing heavy metals. Human-induced impairments are generally associated with individual septic system development in shallow unconfined portions of aquifers or in fractured hard rock areas where insufficient soil depths are available to properly leach effluent before it reaches the local groundwater supply.

The CBDA Water Quality Program has completed the following activities within the Sacramento River region:

- $595,000 invested in local project to protect drinking water quality and watershed health on Steelhead Creek in Sacramento County.
- Sanitary surveys completed for State Water Project and its key sources, including the Sacramento River watershed, which identified potential threats to water quality.
- Pilot study underway on options to reduce dissolved organic carbon and nitrogen exports from rice fields.
- Research funded through Ecosystem Restoration Program to investigate mercury and other pollutants from abandoned mines and/or the impacts of dredge mining.

Ecosystem Restoration

Prior to the Gold Rush of the late 1840s, the area known as the Sacramento Valley consisted of a warm and abundant natural environment, essentially a floodplain to the expansive Sacramento River, rich in natural habitats, such as oaks, sycamore and cottonwood. As the Gold Rush subsided, those it brought to California moved into the plains of the Sacramento Valley and began ranching and farming, clearing the land for these purposes. As the population bases increased in the valley, flood control projects and levees were created in an attempt to control the great river to the detriment of the natural processes of the river and the species that inhabited it. The CBDA Ecosystem Restoration Program attempts to return some of these natural functions to the creeks and rivers within the region to aid in the restoration and maintenance of the endangered species that once inhabited it.

Many ecosystem restoration programs and projects are underway in the Sacramento River Region. Some of these projects are along the main stem of the Sacramento River and others involve work along or in the tributaries. CBDA Ecosystem Restoration and Watershed Program efforts in the Sacramento River Region have focused on protecting and restoring habitat for threatened and endangered species, such as salmonids and other fish species and wildlife. Ecosystem protection and restoration efforts on tributaries to the Sacramento River, as well as the main stem will help to provide habitat for these species while also maintaining water quality in the source area streams that eventually flow into the Bay-Delta.

The Sacramento Valley with its alluvial soils, abundant water and moderate climate, is one of the richest agricultural regions on earth. These same physical attributes also make it an incredibly productive ecosystem that supports over 250 species of fish and wildlife. For example, spring-run Chinook salmon swim in from the Pacific and climb 5,000 vertical feet, first through the Sacramento River and then Mill Creek, to spawn at the base of Lassen Peak. Canadian geese fly from north of the Artic Circle to winter in the wetlands, and Swainson hawks migrate from as far south as Argentina to reach the biologically-rich Sacramento Valley.

During the past 130 years, over 95 percent of the valley’s historic riparian forests have been converted to other land uses. In 1988 federal and state agencies, along with interested stakeholders and regional and local nonprofit groups, began to stabilize this trend by protecting and restoring riparian habitat along the Sacramento River. To date, over 20,000 acres have been protected in such areas as the Sacramento River National Wildlife Refuge, the Bureau of Land Management’s lands north of Red Bluff, Sacramento River State Wildlife Area, other State Parks within the region and various areas under private conservation ownership. In addition, approximately 4,000 acres of flood-prone agricultural land has been restored into riparian forest.

In 1986, the Legislature enacted Senate bill 1086, which called for development of a riparian habitat inventory and created the Upper Sacramento River Fisheries and Riparian Habitat Management Plan. The purpose of this plan is to preserve remaining riparian habitat and reestablish a continuous riparian ecosystem along the Sacramento River. The final plan contained a conceptual Riparian Habitat Restoration Plan to guide riparian habitat restoration along the river and its major tributaries from Red Bluff to Verona. An advisory board with representation appointed by the appropriate local governments was established. This body evolved into the Sacramento River Conservation Area Forum (SRCAF) in 1999. Each of the seven counties bordering the river within this region has a public interest, and a landowner member also serves on this board. The Board meets monthly to help guide activities that take place along the river.

The Management Plan for this program also contained a more specific Fishery Restoration Plan, listing 20 actions to help restore the salmon and steelhead fisheries of the river and its tributaries. All of the proposed restoration actions are now under way, funded by a combination of federal, State, and local sources. The Central Valley Project Improvement Act of 1992 (CVPIA) includes many of the CVP related fishery restoration measures recommended by the SB 1086 plan. (Need more info on CVPIA).

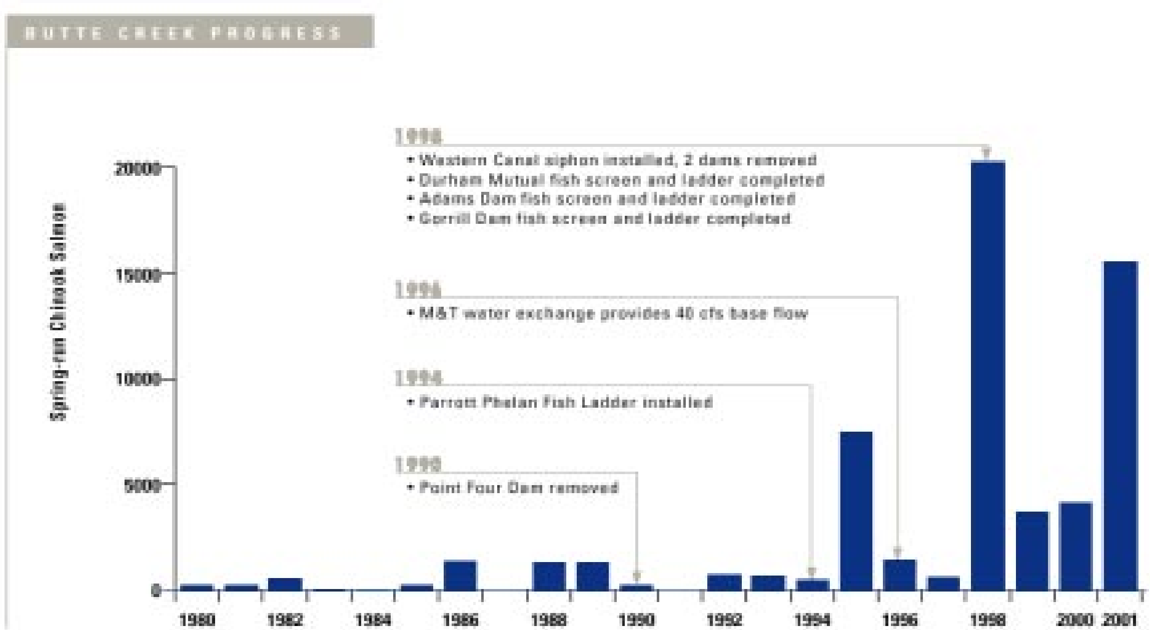
One of the concerns expressed by regional stakeholders involves land acquisitions for restoration projects that may not allow for reimbursement of tax dollars to local governments for land conversion projects. Local governments fear that the loss of revenue from productive agricultural land taken off of the tax roles may impact their ability to provide health and safety programs within their jurisdictions. In response to this concern, since 2000, the CBDA has begun utilizing conservation easements rather than direct purchases. This approach leaves the property on the tax roles, thus minimizing the negative impacts associated with land conversion.

Local governments would also like to see programs that provide for species recovery and protection which support reasonable recreational access for the public that would contribute to an increase in tourism dollars within the local economy. It is anticipated that increased recreation associated with a healthier river system will contribute to the local economy in the future.

Participants in the SRCAF are hopeful that the discussions that take place at the SRCAF, as well as its associated sub-committees, will address some of the concerns expressed above. One of the guiding principles of the program is to give full consideration to landowner, public and local government concerns. It is felt that to ensure that true system-wide planning is effective, the planning process must include participation by local government, environmental groups and agencies along the river. The SRCAF provides the opportunity and encourages this type of participation.

The Sacramento Valley Region is the focus of significant CBDA ecosystem restoration activities and many more are planned for the next several decades including species recovery programs of fish species. The CALFED Multi-species Conservation Strategy (MSCS) is a comprehensive regulatory plan for the CALFED Program developed in accordance with the federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), and the Natural Communities Conservation Planning Act (NCCPA). The MSCS establishes the programmatic state and federal regulatory requirements for numerous species and habitat types throughout the focus area. By adhering to this plan, the program can be implemented in compliance with these regulating acts.

Increased concern over the decline in endangered salmon populations has stimulated several projects and programs within the region over the past several years designed to alleviate pressures on these fish species of concern. Significant work has been accomplished toward this end on Butte Creek, for example. Partnerships with several landowners and agricultural water districts along the creek have resulted in the removal, reengineering, and screening of several dams and the construction of a canal siphon beneath Butte Creek to aid in fish passage for spawning and rearing. These partnerships resulted in the removal of the Western Canal, McPherrin, McGowan, and Point Four Dams and screening modification or construction on five other diversions along this tributary. These efforts, that have been coordinated and partially funded through CBDA, have built strong partnerships within the valley between agencies and landowners. They have also realized an increase in the returning runs of Spring-run Chinook salmon up to their highest level in several years. These numbers are displayed in the following chart through 2001. Data collected from the 2002 and 2003 carcass counts indicate a continued high level of returning spawning populations.



Another major salmon recovery project within the Sacramento River Region is on Battle Creek. The Battle Creek Restoration Program proposes to restore access for salmon and steelhead to approximately 42 miles of habitat in the north and south forks of Battle Creek while minimizing the loss of clean and renewable energy provided by PG&E's Battle Creek Hydroelectric Project. The project includes removal of 5 diversion dams, construction of ladders and fish screens at 3 additional diversions and increasing flow releases from remaining diversion dams. Environmental documents for the project are being finalized and a proposal for additional funds is currently under review by the Ecosystem Restoration Program. The majority landowner within the project area, PG&E, is working with the Bureau of Reclamation, USFWS, NOAA Fisheries, Department of Fish & Game under a Memorandum of Understanding signed in 1999. They are working closely with the Battle Creek Working Group that includes the Battle Creek Watershed Conservancy, other CALFED agencies and other interested parties.

A third example of restoration in the Sacramento River region lies on Clear Creek, which is also a tributary to the Sacramento River, near Redding, in Shasta County. Restoring Clear Creek is identified in several significant documents and/or act of legislation, including CVPIA, Section 3406, (b)(12). Through increasing flow in the creek by releasing more water from Whiskeytown Dam; the removal of McCormick-Saeltzer Dam in the year 2000; supplementing the gravel supply which was blocked by Whiskeytown Dam; implementing methods to control erosion having negative impacts to salmonid habitat; and restoring the stream channel the Clear Creek Restoration Program has contributed significantly to the five-fold increase in fall Chinook spawning escapements in Clear Creek from 1995 to 2002 over the baseline period of 1967 to 1991. Data also show trends of increases in steelhead and Spring-run Chinook spawning and juvenile production.

In addition to the projects discussed above, another program under the ERP which is active in the region is the Environmental Water Program (EWP). The goal of this program is to identify and purchase 100,000 acre feet of water annually to augment in-stream flows. Four of the five Tier 1 priority streams for the program lie within the Region: Clear Creek, Mill Creek, Butte Creek and Deer Creek. The EWP is also working closely with Battle Creek, which has been identified as a Tier 2 priority stream in this program. Development of a regional implementation structure for the Ecosystem Restoration Program Plan that is consistent with and in collaboration with existing local restoration program integration efforts is vital. Development of a regional implementation structure for the Ecosystem Restoration Program Plan that is consistent with and in collaboration with existing local restoration program integration efforts is vital. There are currently numerous watershed groups within the region compiling valuable data and involved in restoration projects within their watersheds. However, these are only a piece of the larger fabric of the greater Sacramento River watershed. Efforts are continuing to provide a comprehensive view of the watershed based on information gathered from funded projects throughout the watershed. This will allow for more informed decision-making and better protection and use of the resources.

Looking to the Future

Water agencies in the region continue to be proactive in managing water supplies in light of changing conditions within the region and the state. An example is the Sacramento Valley Water Management Program (SVWMP). This resource management program was established as an alternative to SWRCB Phase 8 litigation proceedings designed to determine the responsibility of meeting water quality standards in the Delta. This unprecedented agreement establishes a process by which the parties are collaborating in the development and implementation of a variety of water management projects that will increase the availability of Sacramento Valley water resources. The agreement provides that increased supplies will be used first to fully meet the in basin needs, but would also be made available to help meet the requirements of the 1995 Water Quality Control Plan, provide other environmental benefits, and potentially meet additional export needs.

The key to this program is to keep it focused on integrated regional planning. Currently, the SVWMP work team of leading hydrologists and engineers is involved in integrating more than fifty projects into both short and long-term work plans with regional scopes and benefits. These projects are designed to protect Northern California surface water rights and groundwater basins through the implementation of groundwater planning and monitoring that provides for unmet demands within the Sacramento Valley prior to export of water to other regions. They include system improvement and water-use efficiency measures, conjunctive management and surface water re-operation projects that include groundwater protection elements. The SVWMP is based on the tenant that all projects must be managed and controlled by the local interests within the Sacramento Valley. This program is currently undergoing a programmatic environmental review and will seek public funds, including Proposition 50, to help implement many of these projects.

In addition to the Sacramento Valley Water Management Program, several other entities are working to improve water supply reliability and quality within the region and throughout the state. For example, the Redding Area Water Council is considering local water transfers, conjunctive use of groundwater, groundwater management, and additional surface water developments to increase supplies.

The Regional Water Authority is a joint powers authority that serves and represents the interests of nearly 20 water providers in the greater Sacramento Area. The organization’s primary mission is to help its members protect and enhance the reliability, availability, affordability and quality of water resources within this area of the region.

The American River Water Forum has two, co-equal objectives: 1) Provide a reliable and safe water supply for the region's economic health and planned development through the year 2030; and 2) Preserve the fishery, wildlife, recreational and aesthetic values of the lower American River.

The Sacramento Valley Water Quality Coalition (SVWQC) was formed in response to the recent decision by the Regional Water Quality Control Board to revise discharge waivers for agricultural users. This group comprised of County Agricultural Commissioners, Ducks Unlimited, Inc., independent Farm Bureaus from throughout the region, independent landowners and the Northern California Water Association is working with members of the agricultural community to develop a monitoring and reporting program in response to the loss of the discharge waiver. This group is currently identifying participants, collecting contact information and attempting to specify the location of all discharges within the region.

Regional Planning and Coordination

Regional coordination provided by the CBDA in the Sacramento River Region is just beginning and will be focused on fostering regional cooperation and helping regional interests develop programs that are mutually beneficial to the various stakeholders. Efforts will be made to assist the stakeholders within the region by increasing communication within the region and between the region and CBDA Programs.

CBDA staff and state federal and local agencies will work closely with Sacramento Valley stakeholders, including those identified above as well as local elected officials, water district elected officials and staff, public agencies, watershed groups, environmental activists and other interested members of the public. The goal will be to assist the region in the creation of a regional planning strategy. This strategy will allow local stakeholders to have a voice in activities supported by CBDA through funding within the region. It will also outline how the region will coordinate these activities with other regions throughout the Bay-Delta solution area.

In addition to the regional approach being taken along the Sacramento River through the SRCAF, other regional endeavors should be encouraged. For instance, in the northern Sacramento Valley, contiguous aquifer systems underlie several counties. As a result, utilization of the groundwater resource by one county may impact another. Therefore, regional coordination and cooperation is essential for the individual users as well as the benefit of the region as a whole.

Outreach efforts are contemplated to educate local elected officials and landowners about implementation of the CBDA plan in the Sacramento Valley and provide briefings and announcements on regional activities. The coordination of these activities with local governments and local conservation organizations will help inform the local leaders and build trust within the region.

Although many Northern California counties lack the resources and funding to assist them with regional or local plans, several have sought and obtained grant funding and formed working partnerships to help them in this capacity. Both Butte and Tehama County have completed an Inventory/Analysis of their water resources to assist them in future water planning activities. Lake County has recently applied for funding under AB 303 to do the same. Butte County has moved forward with the development of an integrated plan and similar programs regarding groundwater management are being pursued in Glenn, Plumas, Sutter, Shasta, Tehama and Sacramento Counties. Glenn, Tehama and Butte Counties have obtained funding to increase their groundwater monitoring activities through AB 303 grant funding. Several other entities, such as Anderson-Cottonwood Irrigation District, Deer Creek Irrigation District, Glenn-Colusa Irrigation District, Western Canal Water District and Maxwell Irrigation District have all augmented their groundwater monitoring activities within the region as well. A number of other counties and non-profit groups and Resource Conservation Districts (RCDs) within the region have received funding for major ecosystem restoration and conservation programs through the CBDA program.

Water Portfolios for Water Years 1998, 2000 and 2001

The following tables present actual information about the water supplies and uses for the Sacramento River hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 165 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents nearly normal hydrologic conditions with annual precipitation at 110 percent of average for the Sacramento River region, and year 2001 reflected dryer water year conditions with annual precipitation at 70 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 6-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables included in Table 6-2 and companion Water Portfolio flow diagrams Figures 6-2, 6-3 and 6-4 provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 6-3. Because much of the Sacramento River region is devoted to agricultural activities, a large component of the developed water is supplied to agricultural purposes. Dedicated environmental water use is also a large component of the developed water supply, primarily because the required Sacramento – San Joaquin Delta outflow is accounted for within this region. Table 6-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems of the Sacramento River and its tributaries. The use of available groundwater supplies is also a significant resource to this region.

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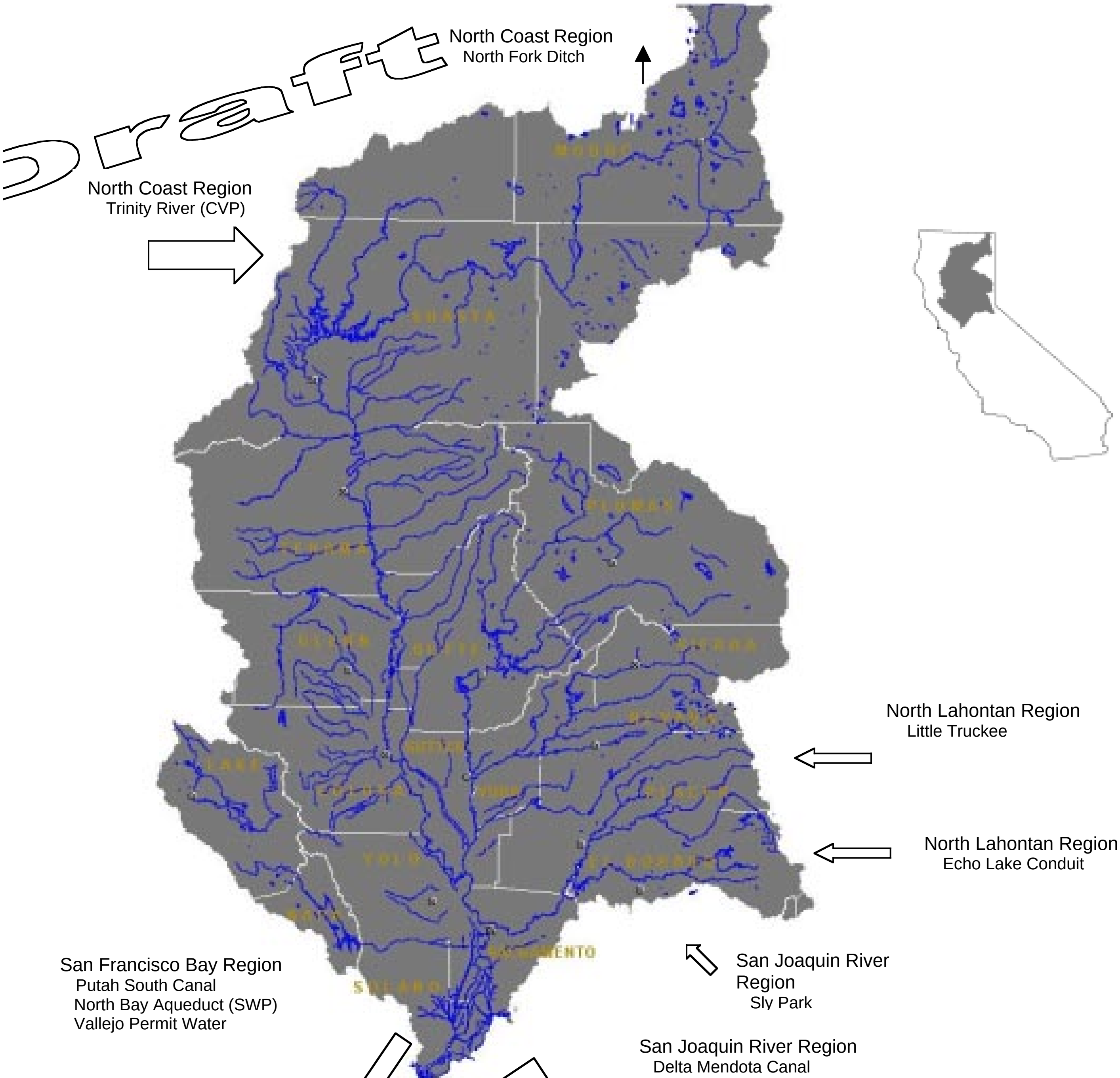
Figure 6-1
Sacramento River Hydrologic Region



Some Statistics

- Area - 27,246 square miles (17.2 % of State)
- Average annual precipitation – 36.7 inches
- Year 2000 population - 2,593,115
- 2030 projected population –
- Total reservoir storage capacity - 16,146 TAF
- 2000 irrigated agriculture - 2,019,700 acres

Table 6-1
Sacramento River Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	89,500	57,106	35,895
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	669	669	669
Total	**90,169**	**57,775**	**36,564**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	4,136	5,549	5,460
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	2,266	5,114	3,761
Statutory Required Outflow to Salt Sink	15,372	12,301	8,796
Additional Outflow to Salt Sink	35,119	12,309	3,947
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	29,784	23,754	18,159
Total	**86,677**	**59,027**	**40,123**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	2,752	-1,101	-2,412
Change in Groundwater Storage **	740	-151	-1,147
Total	**3,492**	**-1,252**	**-3,559**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	6,962	9,202	9,094

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 6-2
Water Portfolios for Water Years 1998, 2000 and 2001

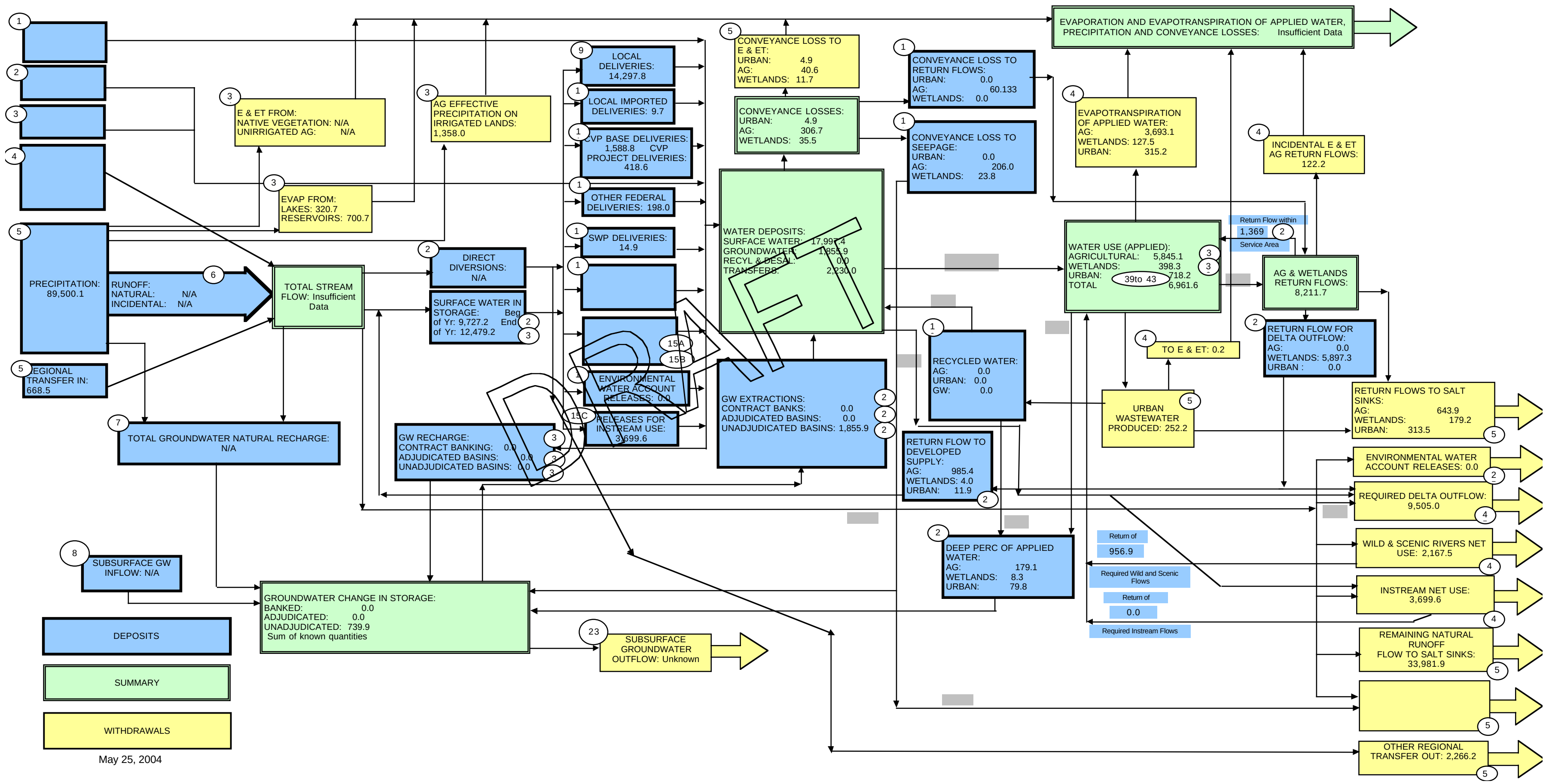
Category	Description	Sacramento River 1998 (TAF)				Sacramento River 2000 (TAF)				Sacramento River 2001 (TAF)				Data Detail
		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	89,500.1				57,105.9				35,894.8				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		14,297.8				12,189.0				8,823.5			PSA/DAU
10	Local Imports		9.7				10.9				8.5			PSA/DAU
11a	Central Valley Project :: Base Deliveries		1,588.8				1,930.8				2,021.3			PSA/DAU
b	Central Valley Project :: Project Deliveries		418.6				554.2				495.7			PSA/DAU
12	Other Federal Deliveries		198.0				228.3				239.5			PSA/DAU
13	State Water Project Deliveries		14.9				14.9				19.6			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		3,699.6				3,759.8				3,747.5			REGION
16	Environmental Water Account Releases						264.0				242.0			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		60.1				44.7				45.3			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-								-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		206.0				270.0				268.2			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		23.8				24.5				13.4			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		-				-				-			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		985.4				1,215.1				957.6			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		4.0				4.2				4.4			PSA/DAU
c	Return Flow to Developed Supply - Urban		11.9				11.8				13.3			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		179.1				299.8				320.3			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		8.3				11.6				12.3			PSA/DAU
c	Deep Percolation of Applied Water - Urban		79.8				88.7				90.8			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		367.7				569.1				446.2			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		1,001.4				1,019.9				619.3			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				219.7			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		5,897.3				4,835.4				4,098.4			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	9,727.2				11,603.3				10,502.6				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	1,855.9				2,803.1				2,922.7				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	12,479.2				10,502.6				8,090.8				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				320.7				331.5				326.1	REGION
b	Evaporation from Reservoirs				700.7				798.5				728.9	REGION
36	Ag Effective Precipitation on Irrigated Lands		1,358.0				1,058.3				1,056.4			REGION
37	Agricultural Use		5,845.1	5,298.3	4,312.9		7,930.8	7,061.9	5,846.9		7,781.6	7,015.1	5,832.7	PSA/DAU
38	Wetlands Use		398.3	345.5	311.3		429.5	377.3	342.9		445.5	378.4	343.8	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		115.2				127.4				132.9			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		231.0				267.7				280.0			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		72.3				88.0				90.4			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		18.1				22.2				22.7			PSA/DAU
40	Urban Commercial Use		112.7				140.3				136.4			PSA/DAU
41	Urban Industrial Use		77.4				84.4				84.4			PSA/DAU
42	Urban Large Landscape		91.5				111.6				119.7			PSA/DAU
43	Urban Energy Production		-				0.3				0.1			PSA/DAU
44	Instream Flow		3,699.6	3,699.6	3,699.6		3,759.8	3,759.8	3,759.8		3,747.5	3,747.5	3,747.5	PSA/DAU
45	Required Delta Outflow		9,505.0	9,505.0	9,505.0		7,231.6	7,231.6	7,231.6		4,486.2	4,486.2	4,486.2	PSA/DAU
46	Wild & Scenic Rivers Use		3,124.4	2,167.5	2,167.5		2,024.7	1,045.4	1,045.4		885.0	320.5	320.5	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				3,693.1				5,008.5				4,913.7	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				127.5				169.7				162.9	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				315.2				371.1				383.6	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				0.2				0.1				0.2	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				122.2				173.4				173.9	PSA/DAU
50	Urban Waste Water Produced	252.2				301.0				311.6				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				4.9				4.3				4.3	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				40.6				61.5				59.9	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				11.7				16.3				15.5	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				643.9				848.7				939.6	PSA/DAU
b	Return Flows to Salt Sink - Urban				313.5				371.7				380.2	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				179.2				164.0				169.4	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				33,981.9				10,924.2				2,457.9	REGION
54a	Outflow to Nevada													REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico													REGION
55	Regional Imports	668.5				668.5				668.5				REGION
56	Regional Exports	2,266.2				5,114.3				3,761.4				REGION
59	Groundwater Net Change in Storage	739.9				-150.8				-1,146.6				REGION
60	Surface Water Net Change in Storage	2,752.0				-1,100.7				-2,411.8				REGION
61	Surface Water Total Available Storage	16,145.6				16,145.6				16,145.6				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 6-3
Sacramento River Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	91.5			111.6			119.7		
Commercial	112.7			140.3			136.4		
Industrial	77.4			84.4			84.4		
Energy Production	0.0			0.3			0.1		
Residential - Interior	187.5			215.4			223.3		
Residential - Exterior	249.1			289.9			302.7		
Evapotranspiration of Applied Water		315.2	315.2		371.1	371.1		383.6	383.6
Irrecoverable Losses		0.2	0.2		0.1	0.1		0.2	0.2
Outflow		311.1	308.5		370.1	367.5		378.6	376.0
Conveyance Losses - Applied Water	9.9			8.5			8.5		
Conveyance Losses - Evaporation		4.9	4.9		4.3	4.3		4.3	4.3
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		5.0	5.0		4.2	4.2		4.2	4.2
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**728.1**	**636.4**	**633.8**	**850.4**	**749.8**	**747.2**	**875.1**	**770.9**	**768.3**
Agriculture									
On-Farm Applied Water	5,845.1			7,930.8			7,781.6		
Evapotranspiration of Applied Water		3,693.1	3,693.1		5,008.5	5,008.5		4,913.7	4,913.7
Irrecoverable Losses		122.2	122.2		173.4	173.4		173.9	173.9
Outflow		1,483.0	497.6		1,880.1	665.0		1,922.4	964.8
Conveyance Losses - Applied Water	615.9			779.9			780.4		
Conveyance Losses - Evaporation		40.6	40.6		61.5	61.5		59.9	59.9
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		206.4	146.3		228.4	183.7		239.8	194.5
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**6,461.0**	**5,545.3**	**4,499.8**	**8,710.7**	**7,351.9**	**6,092.1**	**8,562.0**	**7,309.7**	**6,306.8**
Environmental									
Instream									
Applied Water	3,699.6			3,759.8			3,747.5		
Outflow		3,699.6	3,699.6		3,759.8	3,759.8		3,747.5	3,747.5
Wild & Scenic									
Applied Water	3,124.4			2,024.7			885.0		
Outflow		2,167.5	2,167.5		1,045.4	1,045.4		320.5	320.5
Required Delta Outflow									
Applied Water	9,505.0			7,231.6			4,486.2		
Outflow		9,505.0	9,505.0		7,231.6	7,231.6		4,486.2	4,486.2
Managed Wetlands									
Habitat Applied Water	398.3			429.5			445.5		
Evapotranspiration of Applied Water		127.5	127.5		169.7	169.7		162.9	162.9
Irrecoverable Losses		9.8	9.8		14.4	14.4		14.2	14.2
Outflow		208.2	204.2		193.2	189.0		201.5	197.1
Conveyance Losses - Applied Water	40.8			42.0			23.3		
Conveyance Losses - Evaporation		1.9	1.9		1.9	1.9		1.3	1.3
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		5.2	5.2		5.2	5.2		2.7	2.7
Total Managed Wetlands Use	439.1	352.6	348.6	471.5	384.4	380.2	468.8	382.6	378.2
Total Environmental Use	**16,768.1**	**15,724.7**	**15,720.7**	**13,487.6**	**12,421.2**	**12,417.0**	**9,587.5**	**8,936.8**	**8,932.4**
TOTAL USE AND LOSSES	**23,957.2**	**21,906.5**	**20,854.3**	**23,048.7**	**20,522.9**	**19,256.3**	**19,024.6**	**17,017.4**	**16,007.5**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	14,297.8	14,297.8	13,387.6	12,189.0	12,189.0	11,154.8	8,823.5	8,823.5	8,055.9
Local Imported Deliveries	9.7	9.7	9.1	10.9	10.9	10.0	8.5	8.5	7.8
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	2,007.4	2,007.4	1,879.6	2,485.0	2,485.0	2,274.2	2,517.0	2,517.0	2,298.0
Other Federal Deliveries	198.0	198.0	185.4	228.3	228.3	208.9	239.5	239.5	218.7
SWP Deliveries	14.9	14.9	14.0	14.9	14.9	13.6	19.6	19.6	17.9
Required Environmental Instream Flow	3,962.8	3,962.8	3,962.8	3,422.2	3,422.2	3,422.2	3,133.4	3,133.4	3,133.4
Groundwater									
Net Withdrawal	1,415.9	1,415.9	1,415.9	2,172.6	2,172.6	2,172.6	2,275.9	2,275.9	2,275.9
Artificial Recharge	0.0			0.0			5.0		
Deep Percolation	440.0			630.5			641.8		
Reuse/Recycle									
Reuse Surface Water	1,610.7			1,895.3			1,360.4		
Recycled Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL SUPPLIES	**23,957.2**	**21,906.5**	**20,854.4**	**23,048.7**	**20,522.9**	**19,256.3**	**19,024.6**	**17,017.4**	**16,007.5**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 6-2
Sacramento River Hydrologic Region 1998 Flow Diagram



May 25, 2004

Chapter 7. San Joaquin River Hydrologic Region

Setting

The San Joaquin River Hydrologic Region is located in the heart of California and includes the northern portion of the San Joaquin Valley. It is bordered on the east by the Sierra Nevada and on the west by the coastal mountains of the Diablo Range. It extends from the southern boundaries of the Sacramento – San Joaquin Delta south to include all of the San Joaquin River drainage area to the northern edge of the San Joaquin River in Madera. Roughly half of the Sacramento – San Joaquin Delta region lies within this hydrologic region, encompassing those portions of the Delta within Contra Costa, Alameda, and San Joaquin Counties. The Region extends south from just below the northeastern corner of Sacramento County and eastward to include the southern third of El Dorado County, almost all of Amador County, all of Calaveras and Tuolumne Counties, and the western slope of Alpine County. The San Joaquin River Basin is hydrologically separated from the Tulare Lake Basin by a low, broad ridge across the trough of the San Joaquin Valley between the San Joaquin and Kings Rivers. A map and table of statistics describing the region are presented on page 3.

While one of the state's longest rivers at 300 miles, the San Joaquin River's average unimpaired runoff is approximately 1.8 million acre-feet per year. The San Joaquin River and its eight major tributaries drain about 32,000 square miles. The headwaters of the San Joaquin River begin nearly 14,000 feet above sea level at the crest of the Sierra Nevada. The river runs west down the mountains and foothills, and then flows northwest to the Delta where it meets the Sacramento River. The two rivers converge in the 1,153-square-mile Sacramento-San Joaquin Delta—a maze of channels and islands—which also receives fresh water inflow from the Cosumnes, Mokelumne and Calaveras rivers and other smaller streams. Historically, more than 40 percent of the state's run-off flowed to the Delta via the Sacramento, San Joaquin and Mokelumne rivers.

Climate

Because the San Joaquin Valley is isolated by mountains from the marine effects of coastal California, the average maximum summer temperature in the valley advances to a high of 101 degrees during the latter part of July. The daily maximum temperature during this warmest month has ranged from 76 to 115 degrees. The northern part of this hydrologic region does benefit from “Delta breezes” during the hotter summer periods, typically as consistent winds driven by the strong temperature difference between hot Valley temperatures and cooler marine temperatures in the San Francisco Bay Area. Winter temperatures in the valley floor regions are usually mild but during infrequent cold spells minimum readings occasionally drop below freezing. Heavy frost occurs in most winters, typically between the end of November and early March.

The San Joaquin Valley experiences a range of climate and precipitation, which varies from lesser amounts on the valley floor to medium rainfall amounts in the foothills, and to extensive amounts of snow in the higher ranges of the Sierra Nevada mountains. The climate of much of the upland area west of the valley resembles that of the Sierra foothills. The average annual precipitation of several Sierra Nevada stations is about 35 inches. Snowmelt runoff from the mountainous areas is the major contributor to local water supplies for the eastern San Joaquin Valley floor. The climate of the valley floor is characterized by long, hot summers and mild winters, and average annual precipitation ranges from about 22.5 inches near the Sacramento area in the northeast to about 6.5 inches near the drier southwestern corner of the Region.

Population

The population of the San Joaquin River Region in year 2000 was about 1.7 million, which is about 5 percent of the State's total population. Although there are fifteen counties partially or entirely within the San Joaquin River Region, the majority of the population and land use occurs within 4 counties: San Joaquin, Stanislaus, Merced, and Madera. Of these, the county with the largest population is San Joaquin County (567,800); and it's largest city is Stockton with 243,770 inhabitants. The City of Modesto, located in Stanislaus County (the second largest county at 449,800) has a population of 188,860. The largest city in Merced County (total population of 210,900) is the county seat in Merced with a population of 63,890. Finally, the City of Madera in Madera County (124,400) has a population of 43,210.

California experienced a population increase approaching 15 percent from 1990 to 2000, and the growth rates in San Joaquin valley cities and counties are following this trend. According to California Department of Finance projections, growth rates for the above four counties will range between 21 and 31 percent over the next ten years, with the highest urbanization occurring in the northern portion of this region. For San Joaquin County, projected populations will increase to 747,000 by year 2010 and to 1,229,000 by year 2030. Similarly, the projected population for Stanislaus County will increase to 559,000 by year 2010, and to 744,000 by year 2030. The ongoing rapid rate of urbanization in these regions will generate significant land and water uses challenges for the entire San Joaquin Valley.

Land Use

The valley portion of the San Joaquin region consists primarily of highly productive farmland and rapidly growing urban areas of Stockton, Tracy, Modesto, Manteca, and Merced. Agriculture is the major economic and land use activity in the San Joaquin River Region. The San Joaquin Valley ranks among the most important agricultural regions in California, with roughly 2 million acres of irrigated cropland and an annual output valued at more than $ 4.9 billion. Irrigated acreage is very diversified with about 37 percent planted to permanent crops and 28 percent to grains, hay and pasture. Some of the other major crops include cotton, corn, tomatoes, and other field and truck crops. In addition to agriculture, other important industries in the region include food processing, chemical production, lumber and wood products, glass, textiles, paper, machinery, fabricated metal products and various other commodities.

While the San Joaquin Valley is predominantly privately owned agricultural land, much of the Sierra Nevada Mountains is national forest land. These mountain regions on the east side of the valley include the El Dorado, Stanislaus, and Sierra National Forests and the Yosemite National Park. Public lands amount to about one-third of the region. The national forest and park lands encompass over 2,900,000 acres; state parks and recreational areas and other State-owned property account for about 80,000 acres; and BLM and military properties occupy over 200,000 and 5,100 acres, respectively. The valley portion of the region constitutes about 3,500,000 acres, the eastern foothills and mountains total about 5,800,000 acres, and the western coastal mountains comprise about 900,000 acres. About 1,840,000 (19 percent) of the region's 9,737,200 acres were devoted to irrigated agriculture in 2000.

The restoration of Central Valley wetlands habitat is critical to the preservation of many species of fish and wildlife in the San Joaquin River ecosystem. Beginning in the 1990's agencies and programs began to make progress in efforts to set aside and restore acreage for wetland habitat. In 1990 the San Joaquin River Management Program was formed to identify and plan programs and projects to restore the river system, which led to completion of the San Joaquin River Management Plan (SJRMP) in 1995. This plan identified nearly 80 consensus-based actions intended to benefit the San Joaquin River system, which are organized into the categories of projects, feasibility studies and riparian habitat acquisitions. Many federal and state agencies now have active roles in the funding and implementation of wetlands habitat restoration programs, including the US Fish & Wild Service, the California Bay-Delta Authority and the California Department of Fish & Game. One of the larger current projects along the San Joaquin River is the restoration of 775 acres of native riparian habitat on the West Unit of the San Joaquin River National Wildlife Refuge, located west of Modesto. Approximately 158,000 native trees, shrubs and vines will be planted to accommodate the habitat needs of threatened and endangered species.

The San Joaquin Valley serves as a breeding and resting ground along the Pacific Flyway for many species of waterfowl. Public wildlife refuges in the San Joaquin River Region that support this habitat need include the San Luis National Wildlife Refuge (26,340 acres), San Joaquin River National Wildlife Refuge (2,875 acres), Merced National Wildlife Refuge (8,280 acres), Los Banos Wildlife Area (5,310 acres), Volta Wildlife Area (2,180 acres), the North Grasslands Wildlife Area (2,160 acres), the White Slough Wildlife Area (969 acres), and the Isenberg Sandhill Crane Reserve (361 acres). Towards the northern end of this region, the Cosumnes River Preserve is managed by the Nature Conservancy and has now become the largest refuge area in the region (36,300 acres).

Water Supply and Use

The primary sources of surface water in the San Joaquin River Basin are the rivers that drain the western slope of the Sierra Nevada Mountains. These include the San Joaquin River and its major tributaries, the Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne, and Cosumnes rivers. Most of these rivers drain large areas of high elevation watershed that supply snowmelt runoff during the late spring and early summer months. Other tributaries to the San Joaquin River, including the Chowchilla and Fresno rivers, originate in the Sierra Nevada foothills, where most of the runoff results from rainfall.

In 2000, an average year, about 43 percent of the San Joaquin region's developed water supply came from local surface sources, 24 percent was from imported surface supplies, and groundwater provided about 33 percent of the water supply. About 30 percent of the developed supply (excluding surface and groundwater reuse) was considered dedicated natural flows for meeting instream flow requirements.

Surface water supply systems in the Sierra streams and rivers form a general pattern. A series of small reservoirs in the mountain valleys gathers and stores snowmelt. This water is used to generate electricity as it is released downstream. Some diversions occur for consumptive use in local communities, but most flows are recaptured in larger reservoirs located in the foothills and along the eastern edge of the valley floor. Most of these reservoirs were built primarily for flood control; however, many of them also have additional storage capacity for water supply and other uses included in their design. Irrigation canals and municipal pipelines divert much of the water from or below these reservoirs. Most of the small communities in the Sierra foothills receive much of their water from local surface supplies. The extensive network of canals and ditches constructed in the 1850s for hydraulic mining forms the basis of many of the conveyance systems. In addition to surface water, many of these mountain communities pump groundwater from hard rock wells and old mines to augment their supplies, especially during droughts. Groundwater is the only source for many mountain residents who are not connected to a conveyance system.

On the valley floor, many agricultural and municipal users receive their water supply from large irrigation districts, including Modesto Irrigation District, Merced, Oakdale, South San Joaquin and Turlock Irrigation Districts. Most of this region's imported supplies, about 1.9 million acre-feet per year, are delivered by the federal Central Valley Project. Oak Flat Water District receives about 4,500 acre-feet per year from the State Water Project.

Most of the water in the upper San Joaquin River is diverted at Friant Dam, and is conveyed north through the Madera Canal and south through the Friant-Kern Canal. Average annual diversions from the San Joaquin River through the Friant-Kern and Madera Canals is about 1,500,000 acre-feet. Releases from Friant Dam to the San Joaquin River are generally limited to those required to satisfy downstream water rights (above Gravelly Ford) and for flood control. In the vicinity of Gravelly Ford, high channel losses to the ground water basin occur because the river bed is primarily sand and gravel. Due to the operation of Friant Dam, there are seldom any surface flows in the lower San Joaquin River except for flows originating in the major downstream tributaries plus agricultural and municipal return flows.

The San Joaquin River tributaries provide the San Joaquin River Basin with high-quality water and most of its surface water supplies. Most of this water is regulated by reservoirs and used on the east side of the valley, but some is diverted across the valley to the Bay Area via the Mokelumne Aqueduct, which supplies some for the urban water needs of East Bay MUD, and the Hetch Hetchy Aqueduct, which supplies urban water to the City of San Francisco and several other bay areas cities. Average annual diversion from the Mokelumne and Tuolumne rivers that are directly exported from the basin include 245,000 acre-feet through the Mokelumne Aqueduct and 267,000 acre-feet through the Hetch-Hetchy Aqueduct. Major dams on the tributary streams include Pardee and Camanche dams on the Mokelumne River, New Melones, Donnells, and Beardsley dams on the Stanislaus River, O'Shaunessy and New Don Pedro dams on the Tuolumne River, and Exchequer Dam on the Merced River.

In 2000, an average water year, agriculture accounted for 57 percent of the region's total developed water use, while urban water use was about 5 percent and environmental water use for dedicated purposes was 38 percent of the total. Regional average per capita water use was about 278 gpcd. Imported supplies, including CVP, SWP, and other federal deliveries, amounted to 1,902,300 af. Environmental demands (refuges, instream requirements, and wild and scenic flow requirements) totaled 4,634,000 af.

The following water balance table for the San Joaquin hydrologic region summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, changes in groundwater storage are balanced with the available surface water each year to meet the regions needs. In wet years like 1998, excess water supply is added into ground water storage, while in dry years (like 2001) the amount of ground water pumped to meet water needs results in a net loss of ground water storage.

State of the Region

Challenges

Historically, the surface water originating from Sierra Nevada rivers has proven to be a dependable supply of high quality water, but it meets only about half of the region's total water requirement. Imported surface water and groundwater make up the difference. Due to the reliance on imported surface water from other regions, there is growing concern over the long-term availability of these supplies.

Additionally, proposals to restore fisheries on the San Joaquin River through higher releases of water from Friant Dam have resulted in growing concerns over the long-term availability of the Sierra water supplies.

One of the major challenges facing the region is how to accomplish ecosystem restoration, especially along the San Joaquin River below Friant Dam, since the river receives no significant inflow until its confluence with the Merced River. The river's salmon population upstream of the Merced River, which once was very large, has all but disappeared. Restoring some flow to the San Joaquin River should enhance ecosystem restoration opportunities, but could significantly impact the water supplies for members of the Friant Water Users Authority, as well as have economic impacts on the thousands of farmers, communities, public agencies, related businesses, employees and consumers who depend on the water from Friant Dam.

Groundwater pumping, a major source of supply in the region, continues to increase in response to growing urban and agricultural demands. Over the long-term, groundwater extraction cannot continue to be utilized to satisfy the portion of water demands that are not met by surface water supplies, without producing negative groundwater basin impacts. One such impact is groundwater overdraft, a condition wherein the average long term amount of water withdrawn by pumping exceeds the amount of water that recharges the basin. A serious effect of long-term groundwater overdraft is land subsidence, which results in a loss of aquifer storage space and may cause damage to public facilities such as canals, utilities, pipelines, and roads. To help battle potential serious “overdraft” conditions in some areas of the region, groundwater replenishment is being provided through planned recharge programs, the over-irrigation of crops with extra surface water in wet years, incidental deep percolation, and seepage from unlined canal systems.

In general, groundwater quality throughout the region is suitable for most urban and agricultural uses. Nevertheless, groundwater with high TDS content can be found along the western edge of the valley floor, where the high-saline marine sediments of the Coast Range exist. In addition, the salinity of groundwater in the region increases when the evapotranspiration of crops leaves behind the majority of the salt contained in the applied water. Another water quality concern is nitrates in the region’s groundwater. Nitrates may occur naturally, from the disposal of human and animal waste products, or from the application of fertilizer. Agricultural pesticides and herbicides have also been detected in groundwater samples from the region. The most notable agricultural contaminant detected in samples from the region is dibromochloropropane (DBCP). Industrial organic contaminants detected in samples from the region include TCE, dichloroethylene (DCE), and other solvents, which were found in groundwater samples taken near airports, industrial areas, and landfills.

The major surface water quality problems of San Joaquin Valley streams are a result of significant salt loads from agricultural and wetland drainage and runoff, as well as from the degraded water quality of municipal and industrial wastewater discharges. High salinity is a problem in the lower San Joaquin River, principally under low flow conditions, when there is not enough flow to dilute agricultural return flows into the river. Additionally, high water table conditions along the western side of the San Joaquin River Basin promote subsurface drainage problems. This high water table condition is managed by collecting the drainage water via earthen canals and/or tile drains, conveying it away from the area to storage ponds, reusing it, or allowing it to flow into the San Joaquin River.

Accomplishments

The Reclamation Board of the State of California and the U.S. Army Corps of Engineers (Corps), in coordination with a broad array of stakeholders, have developed a Comprehensive Plan for the flood management system of the Sacramento and San Joaquin River basins. Rather than a physical plan, the Comprehensive Plan constitutes an approach to developing projects in the future to reduce damages from flooding and restore the ecosystem.

The Millerton Area Watershed Coalition will conduct a comprehensive assessment of the San Joaquin River watershed and assess how and what activities need to be changed to better protect and care for the watershed. The information learned will be developed into an outreach activity to promote the protection and enhancement of the watershed including the economic and environmental well being of the communities within it, as well as of the downstream users. This is a CalFed Watershed Program through the U.S. Bureau of Reclamation.

The San Joaquin River Group Authority (SJRGA) was formed in the 1990's in response to the development of the Sacramento – San Joaquin Bay Delta Water Quality Control Plan by the SWRCB. The WQCP was adopted in 1995 and included significant water quality and flow standards for the lower San Joaquin River. The goals of the SJRGA are to investigate fishery and water quality issues on the San Joaquin River, and develop solutions that will protect the salmon fishery and improve water quality. To respond to water quality issues, the Regional Water Quality Control Board is studying agricultural discharge quality controls, and may consider the use of agriculture waivers at a watershed level. Additional water quality monitoring will be necessary to address the various water quality problems on the Lower San Joaquin River. Landowners will have the choice of participating in water quality monitoring and improvement programs on a watershed level or on an individual basis. The watershed approach can be used to identify and address "hot spots" by working directly with individual landowners or encouraging individuals to work together to find solutions.

The SJRGA also led the development of the Vernalis Adaptive Management Plan (VAMP) as a ten year test program designed to study methods to improve salmon smolt survival in the lower San Joaquin River. Starting in year 2000, VAMP has coordinated the release of water from upstream reservoirs each spring to generate a calculated pulse flow down the lower river to help salmon smolts migrate to San Francisco Bay and the ocean. The timing and duration of this pulse flow is coordinated with reduced SWP and CVP Delta export pumping in order to improve Delta flow patterns that will guide the salmon smolts to the ocean. VAMP's technical group coordinates extensively with several local and government agencies to oversee the successful test flow each year, which include real-time facility operations and monitoring, tracking of water flows and fish migration, and outreach and education. It is still too early in the ten year test period to determine how successful this program will be in meeting its objectives.

The Upper San Joaquin River Basin Storage Investigation evolved out of the Cal-fed Record of Decision. The ROD states that "250,000 to 750,000 acre-feet of additional storage in the upper San Joaquin watershed…would be designed to contribute to restoration of and improve water quality for the San Joaquin River and facilitate conjunctive water management and water exchanges that improve the quality of water deliveries to urban communities. Additional storage could come from enlargement of Millerton Lake at Friant Dam or a functionally equivalent storage program in the region." Surface storage options within the San Joaquin River region that may be considered after completion of the CALFED Phase I process include of the investigation of (1) raising Friant Dam, (2) Fine Gold Creek Dam, and (3)

Temperance Flat Dam (3 sites). Additionally, Yokohl Valley Reservoir near Visalia in the Tulare Lake Region is also under consideration.

The cities of Tracy, Manteca, Lathrup and Escalon, in partnership with the South San Joaquin Irrigation District are planning to construct a water treatment plant on the Stanislaus River. The South San Joaquin County Surface Water Supply Project will use water that the SSJID has conserved from its efficient irrigation practices. Water will be taken from Woodward Reservoir, treated to drinking standards and conveyed to the cities. A 40-mile long transmission pipeline would also be constructed from the treatment plant to deliver water to each of the participant cities. The $150 million project is expected to begin deliveries around May 2005. The project is scheduled at that point to deliver 30,000 af/yr to the cities through 2010 and up to 44,000 af/yr thereafter. The intent of the project is to reduce the reliance on groundwater and to provide for future increases in urban demands.

Relationship with Other Regions

The San Joaquin River Region is dependent on receiving surface water from other regions of the State to meet a portion of the developed agricultural and urban water uses. For many years the region has received imported CVP water from the Sacramento-San Joaquin Delta via the Delta Mendota Canal and from the CVP’s Friant Dam, which also diverts Sierra water supplies to the Tulare Lake region. The San Joaquin region also receives some SWP water from the California Aqueduct.

Some surface supplies that original in the San Joaquin region are also diverted across the valley to the Bay Area (San Francisco Bay Region) via the Mokelumne Aqueduct (by East Bay Municipal Utility District) and the Hetch Hetchy Aqueduct (by City & County of San Francisco). The average annual diversions by these two projects from the Mokelumne and Tuolumne rivers are currently about 245,000 acre-feet/year through the Mokelumne Aqueduct and 267,000 acre-feet/year through the Hetch-Hetchy Aqueduct.

Contra Costa Water District recently completed Los Vaqueros Reservoir in 1998, which can hold 100,000 af, is an off-stream reservoir located in the northwest corner of the San Joaquin hydrologic region. This reservoir holds CCWD water that has been diverted water from the Delta in the late winter and spring months. Water is typically withdrawn from Los Vaqueros Reservoir to meet summer demands in the CCWD service area. However, since the CCWD service area is in the San Francisco Bay hydrologic region, this water is considered to be an export from the San Joaquin region. As a new reservoir, Los Vaqueros has only been operated for a few years, such that normal patterns of diversion and water use have not yet been established.

Looking to the Future

The region’s water agencies have many ongoing projects and programs to address water supply problems. These include investigations for new local surface storage projects and investigations for storage development in conjunction with CALFED. Local agencies are further implementing conjunctive use projects and increasing their efforts on water use efficiency and water recycling programs. As the urban cities on the valley floor continue to grow and expand, the current trend of agricultural land conversion to subdivisions is likely to continue. As an outcome of urban expansion, urban water usage is expected to increase in the future, while agricultural water use is projected to decline slightly. The effectiveness of current and planned urban and agricultural water conservation and use efficiency measures will influence these water use trends.

Regional Planning

The San Joaquin Valley Water Coalition is a forum where all the interests in the Valley can come together to discuss common issues related to water supply, quality, and distribution to ensure a water supply for the Valley that is sustainable and meets the needs and concerns of all water users. The Westside Integrated Water Resources Plan, initiated in 2000, is evaluating supply increases and demand reductions to correct the water supply deficits caused by the CVPIA. The West Stanislaus Hydrologic Unit Area Project is a USDA and local grower effort to enhance water quality by reducing soil erosion into the San Joaquin River.

Many other programs are focusing on ecosystem restoration on the Merced, Stanislaus, Tuolumne, and San Joaquin Rivers. The Grassland Bypass Project on the Westside of the valley will consolidate the conveyance of subsurface drainflows on a regional basis and utilize a portion of the federal San Luis Drain to convey drainflows around the Grassland habitat areas into Mud Slough before being discharged into the San Joaquin River above its confluence with the Merced River. The San Joaquin River Parkway and Conservation Trust‘s goals are to preserve and restore San Joaquin River lands having ecological, scenic or historic significance, educate the public on the need for stewardship, research issues affecting the river, and promote educational, recreational and agricultural uses consistent with the protection of the river's resources.

Work is continuing on several programs at the watershed level in the region. For example, the San Joaquin River Management Program is seeking solutions to the common problems facing the region that affect the environment, water quality, agriculture, flood control, etc. within the San Joaquin River watershed, without the limitations imposed by political boundaries. Also, several public/private partnerships on the eastside of the valley are attempting to develop a Comprehensive Plan for the Management, Protection and Restoration of Watersheds of the San Joaquin, Merced, Chowchilla, and Fresno Rivers and to attain designation as a Resource Conservation & Development (RC&D) Area, so watershed projects can be coordinated in Mariposa County and eastern Madera County.

Water Portfolios for Water Years 1998, 2000, and 2001

Water Year 1998

California experienced another El Nino year (July 1997-June 1998) in 1998. The previous El Nino year was in 1991-1992. Precipitation records were broken all over the state, as spring in the Central Valley emerged. Precipitation in Fresno exceeded 180 percent of average, Stockton was almost 200 percent of average, and Los Banos was 248 percent of average. Watershed runoff was well above average, as streamflow in the San Joaquin, Merced, Stanislaus and Tuolumne Rivers was about 165 percent of average.

Total irrigated acreage was about 2,053,600 acres. Alfalfa acreage accounted for 11.5 percent of all irrigated acreage in the San Joaquin region; almonds/ pistachios acreage accounted for 13.8 percent; and vineyard acreage, 10.9 percent. Compared to 1995 acreage, irrigated pasture acreage was down to 15,400 acres; however, acreage was up for corn (36,800), almonds/pistachios (8,600), and vineyards (29,600). Thus, growers continued the trend of converting field cropland to almond/pistachio orchards and vineyards in an effort to find a commodity that would provide better long-term profits.

The El Nino phenomenon had such an impact on the San Joaquin region's volume of precipitation that growers in most cases had little need to irrigate during the first 4 to 5 months of 1998. The total 1998 agricultural applied water was 5.5 maf (47 percent of all uses). The regional average agricultural AW was 2.4 af/ac. Crop evapotranspiration of applied water is also known as the crop water requirement that must be met with irrigation. The total agricultural ETAW in 1998 amounted to 3.4 maf. The regional average ETAW was 1.7af/ac.

Total urban applied water (including residential, commercial, industrial, and landscape) in the region totaled over 515,900 acre-feet. The average per capita water use was about 265 gallons per day, and the urban ETAW was 187,600 acre-feet. Urban applied water accounted for about 4 percent of the total water use in the region. Population for the region was 1,636,210, 2.8 percent more than 1995.

Total environmental demand (instream, wild and scenic, and refuges) for the region was about 5.6 maf acre-feet. This accounts for 47 percent of total uses. This includes water that is reserved for instream and wild and scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 411,400 af or 4 percent of total uses.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 11.7 maf.

Water Year 2000

The weather of water year 1999-2000 in the San Joaquin River Region produced average precipitation and streamflow. Rainfall amounts were slightly above average for most of the measuring stations within the region; precipitation as a percent of average in Madera and Modesto was 120 percent, Stockton 99 percent, and Los Banos 88 percent. Ample moisture was received in the local watersheds, and runoff resulted in good water supplies. Watershed runoff was about average, with unimpaired runoff from the Tuolumne, Merced and San Joaquin rivers at about 103 percent of average. However, the Stanislaus, Mokelumne, and Cosumnes rivers were 99, 89, and 70 percent, respectively. Heavy rainfall occurred in January and February delaying many field activities such as pruning, planting, spraying, and field preparation.

Total irrigated acreage decreased only slightly from 1998 to 2000, reaching 2,050,400 acres. The 2000 almond/pistachio acreage of 292,500 acres was 9,300 acres higher than the acreage in 1998. The acreage of sugar beets dropped 26 percent to 18,500 acres. The acreages of most the remaining crops changed little from 1998.

In general, 2000 weather, water supplies, and evaporative demand were close to average in the San Joaquin region. The total agricultural applied water in 2000 was 7.0 maf (57 percent of all uses), about 27 percent more than 1998. The regional average AW was 3.0 af/ac. The total agricultural ETAW was about 4.4 maf, 29 percent higher than 1998. The regional average ETAW was 2.1 af/ac.

Total urban applied water for the region was 565,800 acre-feet, which was about 10 percent higher than the total urban applied water for 1998. Average per capita water use was around 278 gallons per day, and total urban ETAW for the year was about 211,200 acre-feet. Urban applied water accounted for about 5 percent of the total water use in the region. Population for the region was 1,716,680, 4.9 percent more than 1998.

Total environmental demand (instream, wild and scenic, and refuges) for the region was about 4.6 maf. This accounts for 38 percent of total uses. This includes water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 441,600 af or 4 percent of total uses.

Total supplies, including local and imported (CVP and SWP) surface water, groundwater, and reuse, amounted to 12.2 maf.

Water Year 2001

The 2000-2001 water year started out cooler than normal with cumulative rainfall below average through most of January. Rainfall amounts were slightly less than average for the water year with annual totals of 88 and 83 percent of average in Madera and Stockton, respectively. As the accumulated precipitation lagged in January, large scale weather patterns changed significantly as February approached and a series of Pacific storms moved into the state, helping to bring precipitation totals closer to average. This cool wet period delayed many cultural activities such as pruning, planting, spraying, and ground preparation. A thunderstorm on April 7 brought wind, hail, and heavy rain that damaged grapevines, cotton, grains, and vegetables in Madera and Merced counties; cotton fields damaged by the storm were replanted. The weather became warmer by late April and through the remainder of the growing season offered good growing conditions.

Irrigated crop acreage decreased 7,700 acres from 2000 to a total of 2,042,700. Irrigated pasture acreage declined 28,900 acres (15.4 percent) from 1998; 1998 sugar beet acreage decreased to 7,600 acres, a 70 percent decline. However, miscellaneous truck acreage increased 10,800 acres (16.7 percent) over 1998, and vineyard acreage increased 18,800 acres (8.4 percent), while almond/pistachios have increased in acreage by 13,000 acres since 1998.

The total agricultural applied water for 2001 was 7.1 maf (67 percent of all water uses), 33 percent more than 1998 and 5 percent more than 2000. The regional average AW was 3.2 af/ac. The total agricultural ETAW was estimated to be 4.6 maf. This was about 36 percent higher than 1998 and 5 percent higher than 2000. The regional average ETAW was 2.3 af/ac.

Total urban applied water for the region was 593,800 af, which was 15 percent higher than 1998 and 5 percent higher than 2000. Average per capita water use was about 283 gallons per day, and total urban ETAW was about 219,900 acre-feet. Urban applied water accounted for about 5 percent of the total water use in the region. Population for the region was 1,778,030, 8.7 percent more than 1998.

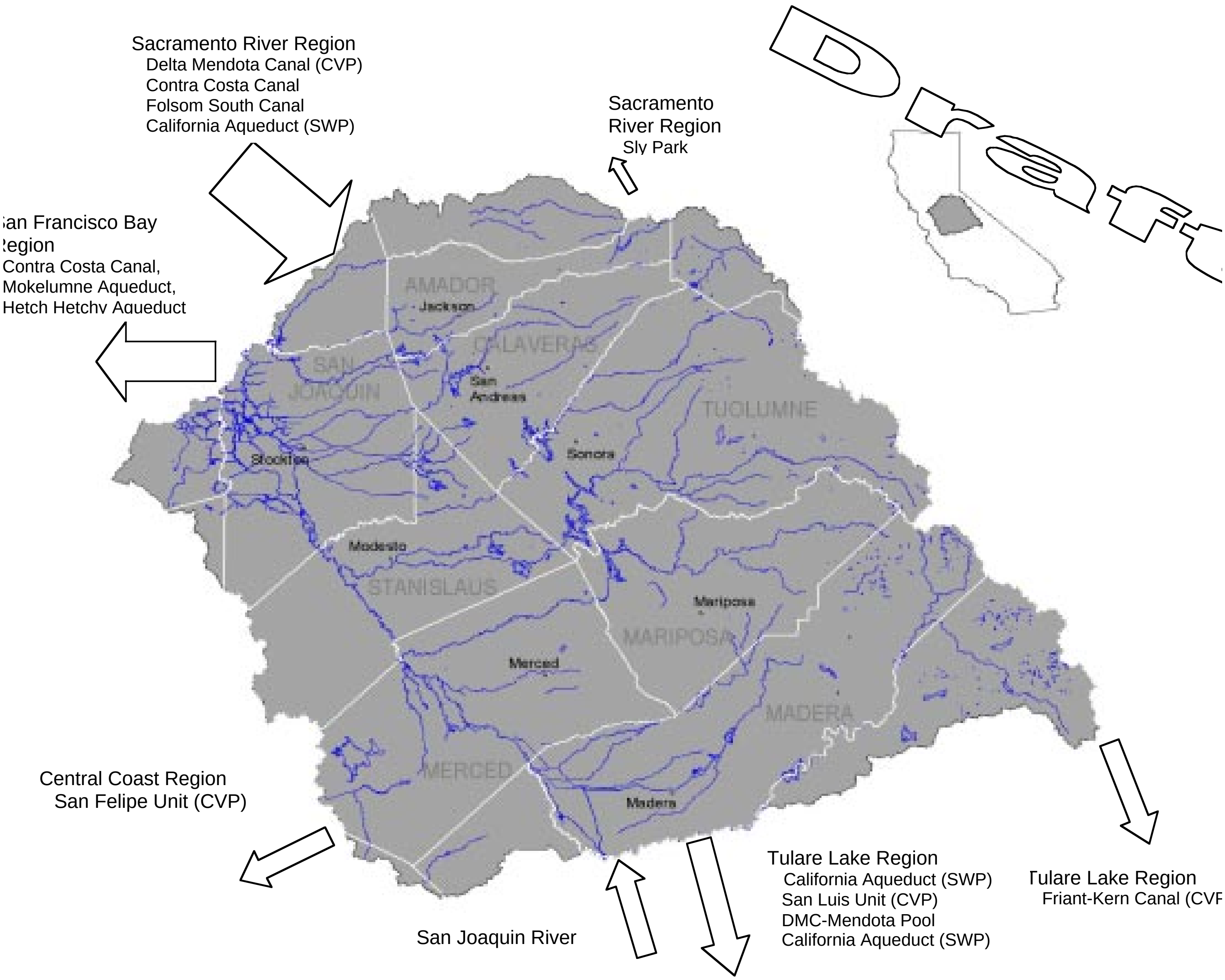
Total environmental demand (instream, wild & scenic, and refuges) for the region was about 2.9 maf. This accounts for 27 percent of total uses. This includes water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 411,700 af or 4 percent of total uses.

Total supplies, including local and imported (CVP and SWP) surface water, groundwater, and reuse, amounted to 10.8 maf.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- U.S. Bureau of Reclamation
- San Joaquin River Management Program Advisory Council
- The Modesto Bee
- Contra Costa Water District

Figure 7-1
San Joaquin River Hydrologic Region
(Revised May 25, 2004)



Some Statistics

- Area - 15,214 square miles (9.6 percent of State)
- Average annual precipitation – 26.3 inches
- Year 2000 population - 1,751,005
- 2030 projected population –
- Total reservoir storage capacity - 11,477 TAF

Table 7-1
San Joaquin River Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	35,535	23,209	16,120
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	5,192	5,288	3,890
Total	**40,727**	**28,497**	**20,010**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	3,702	4,765	4,983
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	4,013	5,848	4,073
Statutory Required Outflow to Salt Sink	0	0	0
Additional Outflow to Salt Sink	146	402	513
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	31,129	17,512	13,208
Total	**38,990**	**28,527**	**22,777**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	2,180	67	-1,435
Change in Groundwater Storage **	-443	-97	-1,332
Total	**1,737**	**-30**	**-2,767**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	6,064	7,524	7,676

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 7-2
Water Portfolios for Water Years 1998, 2000 and 2001

		San Joaquin River 1998 (TAF)				San Joaquin River 2000 (TAF)				San Joaquin River 2001 (TAF)				
Category	Description	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	35,534.7				23,208.5				16,120.2				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	-				-				-				REGION
9	Local Deliveries		3,264.7				3,455.4				3,381.8			PSA/DAU
10	Local Imports		-				-				-			PSA/DAU
11a	Central Valley Project :: Base Deliveries		148.0				167.4				168.2			PSA/DAU
b	Central Valley Project :: Project Deliveries		1,248.7				1,667.0				1,545.2			PSA/DAU
12	Other Federal Deliveries		63.4				63.2				96.4			PSA/DAU
13	State Water Project Deliveries		4.3				4.7				3.5			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		1,528.9				2,098.5				1,424.4			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		6.6				6.6				6.7			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		1.2				1.2				1.2			PSA/DAU
b	Recycled Water - Urban		0.7				0.7				0.7			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		1,259.0				677.1				628.2			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		132.6				126.7				134.2			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		157.7				844.2				910.1			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		174.3				166.5				142.3			PSA/DAU
c	Deep Percolation of Applied Water - Urban		204.1				219.7				226.0			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		5,190.0				4,192.3				2,515.4			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		0.1				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	6,943.0				7,378.6				7,446.0				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	1,750.2				2,655.6				2,954.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	9,122.9				7,446.0				6,010.8				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				77.3				89.7				82.0	REGION
b	Evaporation from Reservoirs				419.9				477.1				449.3	REGION
36	Ag Effective Precipitation on Irrigated Lands		N/A				N/A				N/A			REGION
37	Agricultural Use		5,160.6	5,002.9	3,488.3		6,542.1	5,697.9	4,664.1		6,695.3	5,785.2	4,985.4	PSA/DAU
38	Wetlands Use		411.4	237.1	104.4		441.6	275.1	148.1		411.7	269.4	135.1	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		88.0				103.1				108.4			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		160.6				191.2				203.9			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		92.7				89.9				93.8			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		43.8				44.9				46.1			PSA/DAU
40	Urban Commercial Use		38.7				38.0				40.2			PSA/DAU
41	Urban Industrial Use		34.1				36.1				36.8			PSA/DAU
42	Urban Large Landscape		33.7				37.2				39.5			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		1,528.9	-	-		2,098.5	-	-		1,424.4	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		3,661.1	-	-		2,093.8	-	-		1,091.0	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				3,409.7				4,405.8				4,627.6	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				104.4				148.1				135.1	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				187.6				211.2				219.9	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				N/A				N/A				N/A	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				74.4				11.6				14.3	PSA/DAU
50	Urban Waste Water Produced	76.4				82.9				92.9				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				15.1				16.0				15.7	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				211.9				252.6				248.1	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				37.2				282.5				380.6	PSA/DAU
b	Return Flows to Salt Sink - Urban				109.2				119.3				132.2	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				-				-				-	REGION
54a	Outflow to Nevada													REGION
b	Outflow to Oregon													REGION
c	Outflow to Mexico													REGION
55	Regional Imports	5,191.8				5,287.6				3,890.3				REGION
56	Regional Exports	4,013.3				5,848.3				4,073.1				REGION
59	Groundwater Net Change in Storage	-443.1				-97.2				-1,332.3				REGION
60	Surface Water Net Change in Storage	2,179.9				67.4				-1,435.2				REGION
61	Surface Water Total Available Storage	11,372.3				11,477.1				11,477.1				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 7-3
San Joaquin River Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	33.7			37.2			39.5		
Commercial	38.7			38.0			40.2		
Industrial	34.1			36.1			36.8		
Energy Production	0.0			0.0			0.0		
Residential - Interior	180.7			193.0			202.2		
Residential - Exterior	204.4			236.1			250.0		
Evapotranspiration of Applied Water		187.6	187.6		211.2	211.2		219.9	219.9
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		100.0	100.0		109.9	109.9		122.8	122.8
Conveyance Losses - Applied Water	24.3			25.4			25.1		
Conveyance Losses - Evaporation		15.1	15.1		16.0	16.0		15.7	15.7
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		9.2	9.2		9.4	9.4		9.4	9.4
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**515.9**	**311.9**	**311.9**	**565.8**	**346.5**	**346.5**	**593.8**	**367.8**	**367.8**
Agriculture									
On-Farm Applied Water	4,905.1			6,185.5			6,523.6		
Evapotranspiration of Applied Water		3,409.7	3,409.7		4,405.8	4,405.8		4,627.6	4,627.6
Irrecoverable Losses		74.4	74.4		11.6	11.6		14.3	14.3
Outflow		1,263.2	4.2		923.8	246.7		971.7	343.5
Conveyance Losses - Applied Water	399.9			472.3			457.8		
Conveyance Losses - Evaporation		211.9	211.9		252.6	252.6		248.1	248.1
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		33.0	33.0		35.8	35.8		37.1	37.1
GW Recharge Applied Water	255.5			356.6			171.7		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**5,560.5**	**4,992.2**	**3,733.2**	**7,014.4**	**5,629.6**	**4,952.5**	**7,153.1**	**5,898.8**	**5,270.6**
Environmental									
Instream									
Applied Water	1,528.9			2,098.5			1,424.4		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	3,661.1			2,093.8			1,091.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	411.4			441.6			411.7		
Evapotranspiration of Applied Water		104.4	104.4		148.1	148.1		135.1	135.1
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		132.7	0.1		126.7	0.0		134.2	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	411.4	237.1	104.5	441.6	274.8	148.1	411.7	269.3	135.1
Total Environmental Use	**5,601.4**	**237.1**	**104.5**	**4,633.9**	**274.8**	**148.1**	**2,927.1**	**269.3**	**135.1**
TOTAL USE AND LOSSES	**11,677.8**	**5,541.2**	**4,149.6**	**12,214.1**	**6,250.9**	**5,447.1**	**10,674.0**	**6,535.9**	**5,773.5**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	3,264.7	3,264.7	2,304.0	3,455.4	3,455.4	2,937.0	3,381.8	3,381.8	2,885.5
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	1,396.7	1,396.7	985.7	1,834.4	1,834.4	1,559.2	1,713.4	1,713.4	1,462.0
Other Federal Deliveries	63.4	63.4	44.7	63.2	63.2	53.7	96.4	96.4	82.3
SWP Deliveries	4.3	4.3	3.0	4.7	4.7	4.0	3.5	3.5	3.0
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	810.2	810.2	810.2	891.3	891.3	891.3	1,338.9	1,338.9	1,338.9
Artificial Recharge	255.5			356.6			171.7		
Deep Percolation	684.5			1,407.7			1,444.3		
Reuse/Recycle									
Reuse Surface Water	5,196.6			4,198.9			2,522.1		
Recycled Water	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
TOTAL SUPPLIES	**11,677.8**	**5,541.2**	**4,149.6**	**12,214.1**	**6,250.9**	**5,447.1**	**10,674.0**	**6,535.9**	**5,773.5**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 7-2
San Joaquin River Hydrologic Region 1998 Flow Diagram

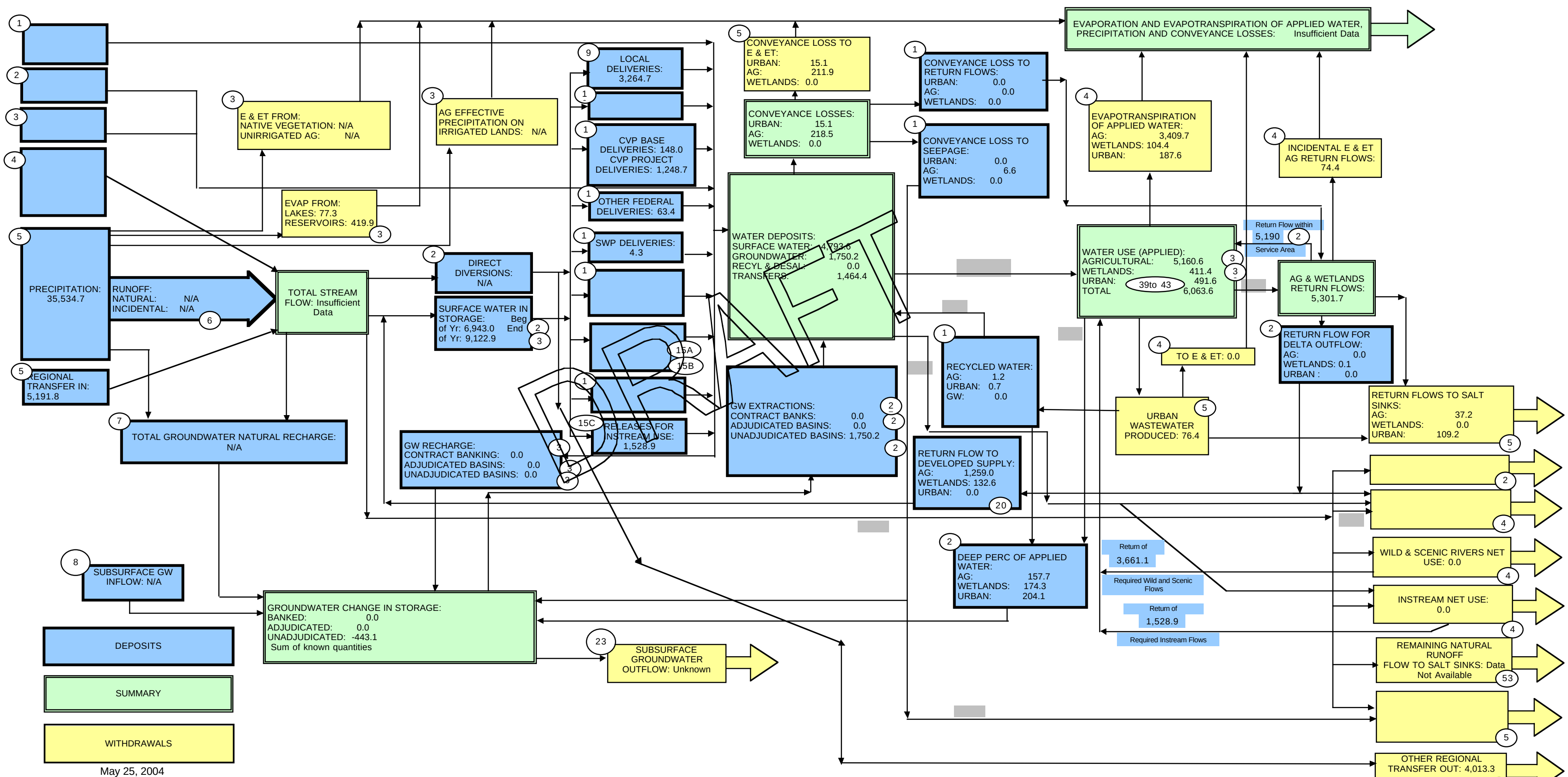


Figure 7-3
San Joaquin River Hydrologic Region 2000 Flow Diagram

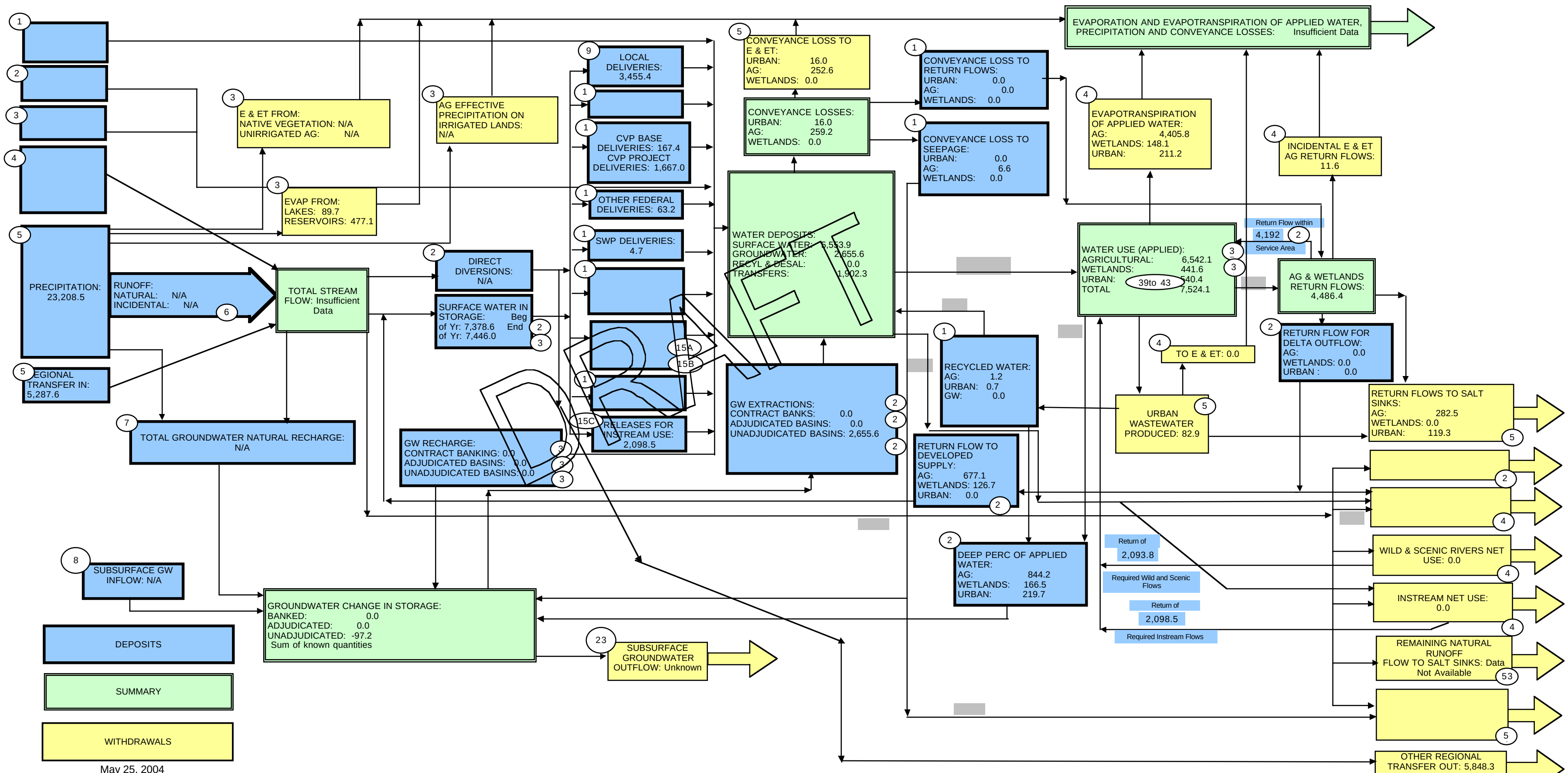
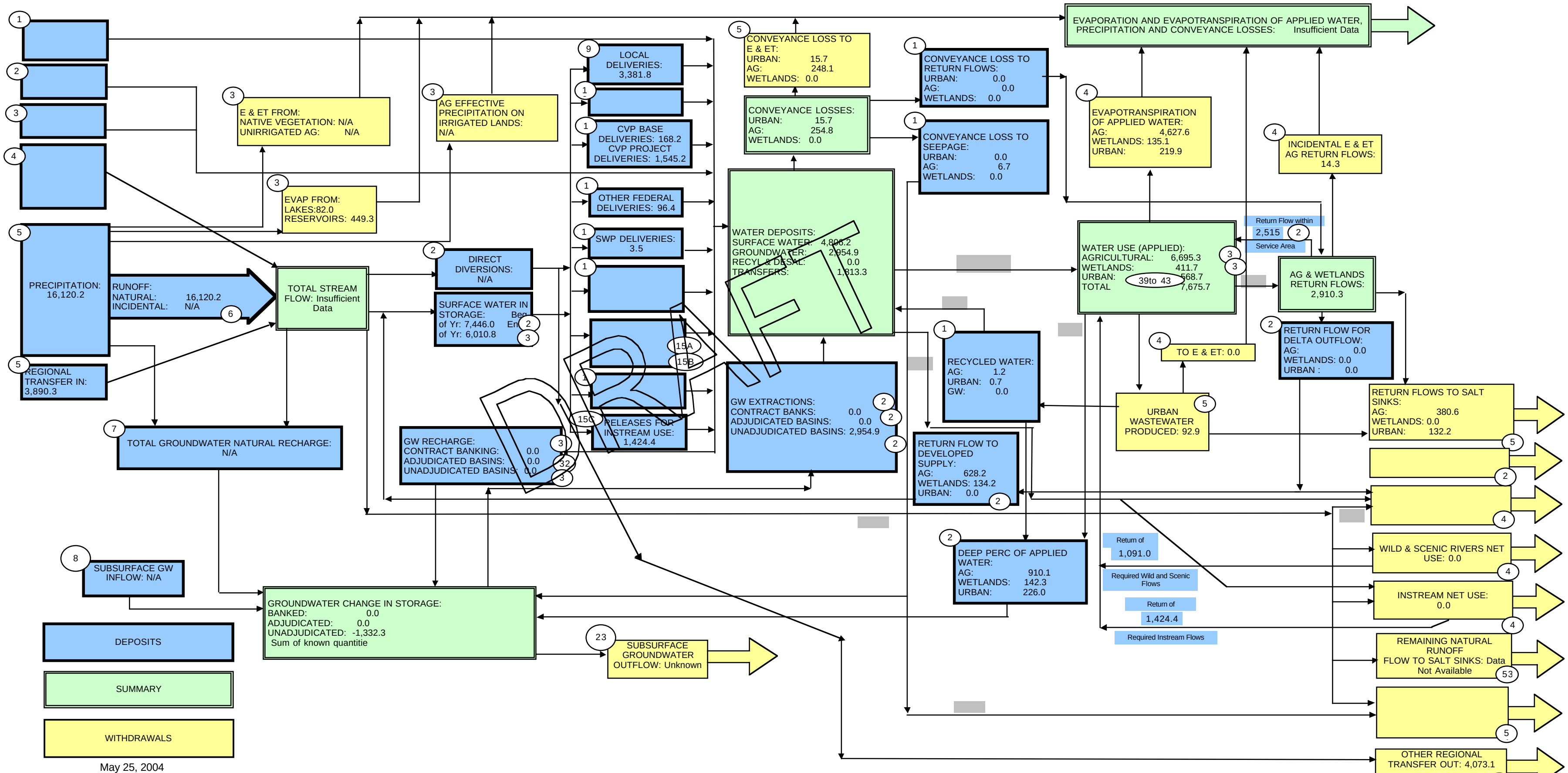


Figure 7-4
San Joaquin River Hydrologic Region 2001 Flow Diagram



Chapter 8. Tulare Lake Hydrologic Region

Setting

The Tulare Lake Region or Basin is located in the southern end of the Central Valley. It is comprised of Fresno, Tulare, Kings and Kern counties. The Tulare Lake Region is one of the nation’s leading areas in agricultural production with a wide variety of crops being grown on approximately 3 million acres. Agricultural production has been a mainstay of the region since the late-1800s. Gross farm receipts from the region account for 35 percent of the state’s total agricultural economy. This Region is also home to a growing number of people. Its population began increasing above historical trends in the 1980s as property in the large metropolitan coastal areas became less affordable. This trend has accelerated in recent years, and the California Department of Finance reported the population at 2 million in 2001. Major cities in this region include Fresno, Bakersfield and Visalia.

Native habitat in the region includes vernal pools, areas of valley sink scrub and saltbush, freshwater marsh, grasslands, arid plains, orchards, and oak savannah. Agricultural farmland in the Central Valley has replaced much of the historic native grassland, woodland, and wetland.

A map and table of statistics describing the region are presented on page 4. The largest river is the San Joaquin which flows along the northern border of this hydrologic region. The California Aqueduct extends the entire length of the west side of the region, delivering water to SWP contractors in the Tulare Lake region and exporting water over the Tehachapi Mountains to southern California. Significant watercourses in the region include the Kings, Kaweah, Tule and Kern Rivers, which drain into valley floor of this hydrologically closed region. The Kern River historically terminated in two smaller lakes, Kern Lake and Buena Vista Lake. These lake bottoms have been dry since the waters that fed them have long since been diverted to irrigation. No significant rivers or creeks drain eastward from the Coast Ranges into the valley.

Climate

Land in the region is well-suited for farming. The valley portion of the region is hot and dry in summer with long, sunny days and cooler nights. Winters are moist and often blanketed with tule fog. Nearly all of the year's precipitation falls in the six months from November to April. The Tulare Lake Region comprises the southern end of the San Joaquin Valley, a broad, flat valley that is surrounded by the Diablo and Coast Ranges to the west and the Sierra Nevada foothills to the east and the Tehachapi Mountains to the south. This results in the comparative isolation of the region from marine effects. Because of this and the comparatively cloudless summers, normal maximum temperature advances to a high of 101^{o}F during the latter part of July. Valley winter temperatures are usually mild but during infrequent cold spells readings occasionally drop below freezing. Heavy frost occurs during the winter months in almost every year. The valley is oriented from the northwest to southeast, and northwest winds are common.

The mean annual precipitation in the valley portion of the region ranges from about 6 to 11 inches, with 67 percent falling from December through March, and 95 percent falling during the winter months from October through April. The Tulare Lake Region enjoys a very high percentage of sunshine, receiving more than 70 percent of the possible amount during all but the four months of November, December, January, and February. During periods of tule fog, which can last up to two weeks, sunshine is reduced to a minimum. This fog frequently extends to a few hundred feet above the surface of the Valley and presents the appearance of a heavy, solid cloud layer. These prolonged periods of fog and low temperatures are important to the deciduous fruit industry.

Population

The rate of population growth in the San Joaquin Valley is among the highest in the state, creating a greater demand for housing and urban infrastructure. The population in the Tulare Lake Region is about 60 percent of the entire San Joaquin Valley population. While many communities in the region welcome the growth and income from a diversifying economy, they are beginning to feel the impacts on farmland from this growth. In six short years, between 1992 and 1998, nearly 37,000 acres of farmland were converted to urban uses according to Department of Conservation figures. Even though there is a concern about accelerated urbanization and the subsequent loss of farm land, relatively few private agricultural preservation efforts can be cited in the San Joaquin Valley. The rapidly growing cities of Fresno/Clovis metro area, Bakersfield, Visalia and Tulare are located in the valley portion of the region. Other smaller population centers include Hanford, Porterville, Coalinga and Delano.

Household incomes and housing prices in the Tulare Lake Region are lower on average, compared to the rest of the state. New jobs in services, industries, construction, and agriculture are generally low-skilled and low-wage jobs, subject to seasonal fluctuation. As a result, unemployment consistently exceeds the state and national rates by as much as 10 percent. According to a recent Public Policy Institute of California special survey, the top 5 most pressing issues to residents were related to population growth and development. They include, population growth (17 percent), pollution (14 percent), water supply and quality (11 percent), jobs and economy (10 percent), and loss of farmland (8 percent).

Population density varies widely on a county-by-county basis, and large portions of some counties are virtually unpopulated. Much of the population lives in the more densely developed cities and towns.

Population in the Tulare Lake Region was about 1.65 million in 1990 and reached 1.97 million by 2000. This is nearly a twenty percent growth rate over this ten year period. Between 1998 and 2000, the population increased slightly more than 3 percent, and California DOF statistics project continued growth rates of 18 percent to 21 percent for these four counties over the next ten years.

Land Use

The State and federal governments own about 30 percent of the land in the region, including about 1.7 million acres of national forest, 0.8 million acres of national parks and recreation areas, and 1 million acres of land managed by the U.S. Bureau of Land Management. The region's foothills border Kings Canyon and Sequoia National Parks and Sierra National Forest. Privately owned land totals about 7.4 million acres. Irrigated agriculture accounts for more than 3 million acres of the private land, while urban areas take up over 350,000 acres. Other agricultural lands and areas with native vegetation cover an additional 1,400,000 acres.

The unique climate and soils of the Tulare Lake Region contribute significantly to the tremendous production obtained from the land and the diversity of crops grown. Tulare Lake region counties include three of the top five leading California agricultural counties by total value of production. Over 250 crops and farm commodities are produced in the region. While cotton was king for many years, more recently grapes have outpaced cotton in terms of gross receipts. Alfalfa comprises over 10 percent of the irrigated acreage in California and about 12 percent of the three million irrigated acreages in the region. Alfalfa acreage in the region has been rising in recent years in response to the demand for quality alfalfa by the expanding dairy industry. Tulare County, in the heart of the region, is the nation's richest dairy county. Deciduous and citrus trees are the main agricultural crops in the lower foothills, while livestock grazing and timber harvesting occur in the higher elevation areas.

The Central Valley constitutes less than 1 percent of the United States farmland but produces 8 percent of total agricultural output. Further, while over 12 percent of the national gross receipts for farming came from California agriculture's approximately 89,000 farms, over 4 percent of these came from the Tulare Lake Region alone. According to the California Department of Agriculture, total California agricultural production and gross cash income in 1998 declined 6 percent from prior year 1997, and statewide gross income in 2001 increased 1 percent from 2000. By comparison, agricultural production and cash income in the Tulare Lake Basin in 1998 declined to $9.1 billion, which was only a 3.7 percent decrease from 1997. In 2001 Tulare Lake Basin agricultural production increased by 3.4 percent (over year 2000) to $9.9 billion.

Some crops and farm commodities that are produced primarily in the Tulare Lake Region experienced dramatic increases in export value in 2001. Table grapes, milk and cream, and walnuts all showed double digit percentage increases in export value from 1998. However, the majority of farm commodities experienced declines in export values between 1998 and 2001. Seven of the top ten exported crops/commodities declined in value. These included almonds ($760 million to $686 million), cotton ($734 million to $605 million), and wine ($506 million to $491 million).

Water Supply and Use

This region receives most of its surface water runoff from four main rivers that flow out of the Sierra Nevada Mountains, which are the Kings, Kaweah, Tule, and Kern rivers. The use of water from these rivers has played a major role in the historic and economic development of the region. Major water conveyance facilities for the area include the California Aqueduct, the Friant-Kern Canal, and the Cross Valley Canal. Water districts within the region have developed an extensive network of canals, channels, and pipelines to deliver developed water supplies to customers. Water storage facilities and conveyance systems control and retain runoff from the watersheds in the Tulare Lake Region, except in extremely wet years when floodwaters may exit the region. During flood years, excess water flows down the north fork of the Kings River toward Mendota Pool and on to the San Joaquin River. In the wettest years, Kings River floodwaters reach the Tulare Lake bed via the south fork of the river. Excess runoff from the Kaweah and Tule Rivers may also flow into Tulare lakebed, flooding low-lying agricultural fields. Excess surface water is managed to the maximum extent in artificial groundwater recharge facilities. In the rare event water leaves the basin, it is because the absorptive capacity of the ground water systems in the region has been exceeded. When this happens water is diverted northward and southward through the Kern River intertie into the California Aqueduct to avoid local flooding.

Captured and stored water in many Sierra Nevada reservoirs is used to generate electricity as it is released downstream. Some diversions occur for consumptive use in local communities, but most flows are recaptured in larger reservoirs located in the foothills and along the eastern edge of the valley floor. These reservoirs were built primarily for flood control; however, many of them were also designed to have additional storage capacity for conservation purposes. Canals and pipelines divert much of the water from or below these reservoirs. Smaller communities in the Sierra foothills receive their water from local surface supplies and groundwater. These mountain communities pump groundwater from hard rock wells and old mines to augment their supplies, especially during droughts. Groundwater is the only source for many mountain residents who are not connected to a municipal conveyance system.

Major statewide water projects within the Tulare Lake Region include the State Water Project’s (SWP) California Aqueduct (which has a state/federal joint use portion known as San Luis Canal) along the western side of the valley. Sacramento-San Joaquin Delta water is brought into the region through the California Aqueduct. CVP supplies are also sent down from the Delta through the SWP to agencies with federal entitlements on the west side of the valley, such as Westlands Water District. The CVP’s Friant-Kern Canal runs south along the eastern side of the valley and transports San Joaquin River water to agencies along the valley’s eastern side and Kern County. The Friant Unit of the CVP also diverts water northward from Millerton Lake via the Madera Canal.

The SWP provides an average of about 1,200,000 af of surface water annually to the region, which is used for both agricultural and urban purposes. The U.S. Bureau of Reclamation supplies an average of 2,700,000 af from the CVP via Mendota Pool, the Friant-Kern Canal, and the San Luis Canal, primarily for agricultural uses.

Groundwater has historically been important for both urban and agricultural uses. It accounts for 33 percent of the region’s total annual supply and 35 percent of all groundwater use in the State. Additionally, the region’ groundwater represents about 10 percent of the State’s overall supply for agricultural and urban uses. Many valley cities, including Fresno, Visalia and Bakersfield, rely primarily on groundwater. Bakersfield occasionally obtains supplemental supplies from local surface water and some imported water. These cities also have groundwater recharge programs to help ensure that groundwater will continue to be a viable water supply. On the valley's western side, smaller cities like Avenal, Huron, and Coalinga rely on imported surface water from the San Luis Canal to meet municipal demands. This surface water replaces groundwater of poor quality.

Most towns and cities along the east side of the valley floor rely on groundwater for municipal use. The largest cities of Fresno and Visalia are, at this time, entirely dependent on ground water for their supply. Fresno is the second largest city in the United States reliant solely on ground water. Fresno, Visalia, Bakersfield and other cities have groundwater recharge programs to ensure that groundwater will continue to be a viable water supply.

In addition to the recharge programs employed by some valley cities, extensive groundwater recharge programs (know as water banks) are also in place in the south valley where water districts have recharged several million acre-feet of surplus water for future use and transfer through water banking programs. For over 100 years, water supply and irrigation districts throughout the region have used conjunctive use practices to maximize water supply and maintain the groundwater system. Other conjunctive use practices utilized throughout the valley include water exchange and transfer programs.

The table on page 9 presents a water balance summary of the Tulare Lake Region. A comparison of regional urban, agricultural and environmental water uses indicates that urban water use is about 5 percent, agricultural water use is 84 percent and environmental water use is about 11 percent of the developed water supplies.

Many different crops are grown throughout the region. Most of the agricultural land in the Tulare Lake region lies in organized water districts. Many water districts in recent years have actively been changing water management practices and physical structures to improve the efficiency of water delivery and use.

Urban water use accounts for about 5 percent of the total applied water in the region. Many of the communities in the region that are served by agency-produced water are not metered, and customers are charged a flat rate for water use. However, urban communities are gradually working towards the installation of water meters over time as funding allows. Legislation (AB 514) that requires all California cities that receive water from the CVP to install and use water meters was signed into law in October of 2003. Some of the larger cities that are effected include Sacramento, Folsom and Fresno. In Fresno, the new law is being viewed as an ideal solution to a longstanding problem. It is believed the new law will remove the requirement for Fresno to obtain voter approval of another charter amendment to permit metering. The U.S. Bureau of Reclamation and the federal Department of Interior have made the installation of water meters a requirement, if Fresno plans to renew its CVP contract for 60,000 acre-feet of surface water from the Friant Division.

The variability of industrial water use is a function of economic, climate, and technological factors. Agriculture harvest schedules have a large impact. Local water agencies supply water to most of the smaller industrial facilities situated in cities within the region. However, larger industrial and institutional water users both inside and outside urban areas generally develop their own ground water supplies or divert from local streams. Higher per capita water use in areas like Fresno and Bakersfield are generally due to their higher concentration of these industries. In the case of Bakersfield, the oil industry and food processing comprise a large segment of industrial water use activities.

Water Recycling

In the Tulare Lake Region, discharge of recycled water is regulated through the Regional Water Resources Control Board as identified in the Board’s Tulare Lake Basin Plan. The significant increase in population in the Tulare Lake Region has resulted in a rising volume of recyclable water. This has forced municipalities to reassess collection, transmission and treatment capacities of their wastewater facilities to handle increasing volumes. Most of the recycled water in the region is used for irrigation and groundwater recharge. The remainder is evaporated. There are several cities that have built delivery systems for agricultural irrigation use such as Bakersfield. In those situations where effluent is discharged, a discharge permit must be obtained as part of the EPA National Pollutant Discharge Elimination System (NPDES) Permitting Program. Water Water reuse in the TLR is currently estimated to be over 150 TAF in year 2000. Groundwater recharge programs account for over half of all recycled water used.

State of the Region

Challenges

Whenever a region looks outside of its borders for water supply augmentation, statewide water management and integrated resource planning come into the picture. Depending on the package of options chosen, one region's actions can affect another region's supplies. The statewide planning process involves assessing trends in each region's water demand and quantifying the cumulative effects of each region's demand and use patterns on statewide supplies. It basically parallels the planning process at the local and regional levels. By working through a statewide planning process, the magnitude of both intra- and inter-regional effects can be analyzed. However, in a number of circumstances, measures that would be taken to manage demand, to increase supplies, or to improve water service reliability are local decisions. These decisions must weigh the cost of increased reliability with the economic, environmental, and social costs of expected shortages.

In the short term, those areas of California that rely on the Sacramento – San Joaquin Delta for all or a portion of their surface water supplies face uncertain water supply reliability due to the evolving outcome of actions being implemented to protect aquatic species and water quality. At the same time, California's water supply infrastructure is severely limited in its capacity to transfer marketed water through the Delta due to those same operating constraints. Until solutions to complex Delta problems are identified and put in place and demand management and supply augmentation options are implemented, some water dependent regions will experience imported water shortfalls. Such limitations of surface water deliveries will exacerbate groundwater overdraft in the Tulare Lake Region because groundwater is used to replace much of the shortfall in surface water supplies. In addition, water transfers within these areas have and will become more common as farmers seek to minimize water supply impacts on their operations. In urban areas, water conservation and water recycling programs will be accelerated to help offset short-term water needs. The recently approved Proposition 50 provides the mechanism for funding projects to augment systems and supplies, optimize delivery systems, utilize recycled water and increase water management efficiency.

Groundwater pumping, a major source of supply in the Tulare Lake region, continues to increase in response to growing urban and agricultural demands. If groundwater extraction continues to be utilized to offset anticipated but unmet surface water imports, negative groundwater impacts will continue to occur. One such impact of long-term groundwater overdraft is land subsidence, which results in a loss of aquifer storage space. This has already caused some damage to public facilities such as canals, utilities, pipelines, and roads in the region. In an effort to slow this condition, many water agencies have adopted groundwater replenishment programs, and have taken advantage of excess water supplies available in wet years, incidental deep percolation, and seepage from unlined canal systems.

Groundwater quality is general good throughout the eastern portion of the valley floor. Much of the groundwater in the western valley floor area is high in salinity and not suitable for use, resulting from percolating through marine sediments located in of the western geological formations. Isolated areas of groundwater contain elevated levels of nitrates, sulfates, and some historically used chemicals such as dibromochloropropane (DBCP) used in agriculture and trichloroethylene TCE, dichloroethylene (DCE), used as solvents.

The Tulare Lake Region includes significant areas that have been experiencing drainage problems for many years. The need for proper drainage has long been recognized by federal and State agencies. Planning for drainage facilities to serve the San Joaquin Valley began in the mid 1950s. The poorly drained area is concentrated along the western side of the San Joaquin Valley from Kern County northward into the San Joaquin River Region. Although the San Joaquin Valley has some of the most productive agricultural lands in the world, much of the west side of the Valley is plagued by poor subsurface drainage conditions that adversely impact crop productivity. Between 1977 and 1991 the area affected by saline shallow groundwater on the west side doubled to about 750,000 acres. At present, a substantial portion of the Valley, about 2.5 million acres, is threatened by saline shallow groundwater.

In addition, the drainage water is sometimes contaminated with naturally occurring, but elevated, levels of selenium, boron and other toxic trace elements that threaten the water quality, environment, and fish and wildlife. Water planners had originally envisioned a master surface water drain to remove this poor quality water, but that proposal was never completed. The U.S. Bureau of Reclamation has an obligation to provide agricultural drainage service to CVP westside acreage, and a portion of that drainage service system, the San Luis Drain, was constructed. This drain currently carries water northward to storage and evaporation ponds the Kesterson Wildlife Refuge.

The monitoring of San Joaquin Valley agricultural drainage water began in 1959 as a cooperative agreement between the California Department of Water Resources and the University of California. In 1984 the San Joaquin Valley Drainage Program was established as a joint federal and State effort to investigate drainage and drainage-related problems and identify possible solutions. In September 1990 the San Joaquin Valley Drainage Program summarized its findings and presented a plan to manage drainage problems in a report entitled *"A Management Plan For Agricultural Subsurface Drainage and Related Problems in the Westside San Joaquin Valley "*. In December 1991, several federal and State agencies signed a memorandum of understanding, and released an implementation strategy entitled "*The San Joaquin Valley Drainage Implementation Program*." The purpose of the 1991 MOU and its strategy document was to coordinate various programs in implementing the 1990 recommendations.

In 1997 an Activity Plan was initiated by the SJVDIP and the University of California to review and evaluate the 1990 Plan and update its recommendations. Eventually, the San Joaquin Valley Drainage Authority which includes districts in the Grassland, Westlands, and Tulare subareas was formed to develop a long-term solution for drainage problems in the Valley, which could include out-of-valley disposal. Studies continue in pursuit of cost effective ways to dispose of the drainage water.

In 2002, the U.S. Bureau of Reclamation released the San Luis report, which declared that an "in-valley" solution to the drainage problem on the Valley's Westside should be implemented. The proposed alternative includes the following features: a drainwater collection system, regional drainwater reuse facilities, selenium treatment, reverse osmosis treatment for the Northerly Area, and evaporation ponds for salts disposal.

Also in 2002, the Westlands Water District, and the United States reached a settlement agreement regarding drainage that the U.S. was legally bound to provide to Westside farmers. As a result of this agreement, the number of acres requiring drainage service in the San Luis Unit will initially be reduced by retiring approximately 33,000 acres, part of a proposal to retire up to a total of 200,000 acres.

Accomplishments

Many water districts in recent years have actively been trying to improve water delivery and use efficiency. About 14 individual water districts encompassing over 1.3 million acres have become signatories to the Agricultural Water Management Council and have prepared Agricultural Water Management Plans. In addition, many water districts are working with growers to improve on-farm water management systems. This assistance includes providing irrigation scheduling information, assistance in obtaining low interest loans, water trading, delivery augmentation and irrigation system evaluations.

On the western side of the San Joaquin Valley, particularly in Fresno and Kings Counties, farmers are using more sprinkler irrigation and less flood, basin, or furrow irrigation, reducing incidental deep percolation, a very beneficial source control measure in the areas with problematic high water tables. In addition, improved management of the remaining furrow and basin irrigation and cropping systems are showing success. In 1998, less than half of the irrigated land was flood irrigated.

Many farmers use sprinklers and drip irrigation, especially on truck crops where small applications of water early in the growing season are very beneficial. The amount of water applied during the pre-irrigation of cotton and other crops has been significantly lowered via increased use of sprinklers. Buried drip irrigation systems have been increasing in acreage, as the proper equipment and designs are proven successful. Also, almost all new plantings and replanting of orchards and vineyards utilize drip or micro-sprinkler irrigation systems and many older plantings are being converted from furrow or basin systems, where conditions are favorable for success. As trees and vines age, their yields decrease to a point where returns are no longer profitable and must be replanted. Thus, eventually nearly all trees and vines with conditions favorable to their use in the region will be irrigated with micro-irrigation.

The Department of Water Resources conducted a survey of irrigation methods being used to irrigate crops in Kern County in conjunction with its summer land use survey performed in 1984 and 1998 (see table below). In general, adoption of micro-irrigation systems has increased dramatically in all permanent crop plantings over this period. For example, the truck crop category changed from zero micro to almost 5 percent.

Percentage of Acreage of Each Crop Category
By Irrigation Method used – Kern County

	1984	1998	1984	1998	1984	1998
	SURFACE		SPRINKLER		MIRCRO	
GRAIN	52.1	46.1	47.9	53.9	0.0	0.0
FIELD CROPS	63.9	77.2	36.1	22.8	0.0	0.0
ALFALFA	77.2	88.3	22.8	11.7	0.0	0.0
PASTURE	76.9	81.7	23.1	18.3	0.0	0.0
TRUCK CROPS	17.4	24.9	82.6	70.5	0.0	4.6
DECIDUOUS ORCHARD	41.9	29.9	27.2	6.1	30.9	64.0
SUBTROPICAL	13.8	2.8	23.4	0.6	62.8	96.6
VINEYARD	59.2	36.1	15.7	1.8	25.2	62.1

In general, management of irrigation systems, including non-pressurized irrigation systems (furrow and basin) has been improving. Economic pressure has caused increasing farm efficiency. The pressures include, higher production costs, higher utility rates, and low crop prices. Farmers are using a wider availability of crop irrigation scheduling information and training, soil moisture monitoring programs and public outreach and training efforts by the U.C. Cooperative Extension, irrigation districts and others to respond to these pressures. Finally, as agricultural production continues to experience a price/cost squeeze, farming operations throughout the region are tightening the use of all production inputs, including water by improving irrigation management based on better knowledge of crop evapotranspiration requirements and soil moisture needs, and nutrient management.

Efforts to improve water use in the urban sector began earnestly during six year drought which began in 1987. The California Urban Water Conservation Council was created in 1991 by the historic signing of the "Memorandum of Understanding Regarding Urban Water Conservation in California"**.** The CUWCC is composed of urban water agencies, public interest organizations, government and private entities. Together these organizations work to promote efficient water use statewide. Many water and utility companies throughout the State offer financial and technical assistance programs that specifically help those who are on a limited budget to implement water and energy efficiency improvement in their home.

The water agencies in the Tulare Lake region that have submitted urban water management plans are : West Kern Water District, North of the River MWD, East Niles Community SD, Oildale Mutual Water Company, Vaughn Water Company, City of Bakersfield, City of Corcoran, City of Lemoore, City of Reedley, City of Hanford, Kern County Water Agency and City of Sanger. Of these agencies the City of Sanger and Kern County Water Agency have approved urban water management plans.

Regarding groundwater, AB 3030 (California Water Code Section 10750 et seq.) allows certain defined existing local agencies to develop a groundwater management plans. Groundwater basins are explained and defined in DWR Bulletin 118. No new level of government is formed and action is voluntary. Prior to AB3030, the Water Code was amended by AB 255 in 1991 to allow local agencies overlying critically overdrafted groundwater basins to develop groundwater management plans. There are six water agencies in the Tulare Lake region that prepared groundwater management plans under AB 255. Following AB 3030 legislation, 26 groundwater management plans have been adopted in the region.

Cities and counties are continually introducing new technology while maintaining, servicing, expanding, and updating their water systems. After years of violating state drinking water standards for taste and smell, the City of Mendota, in western Fresno County, will be bringing a new water system online that promises to bring about a new self-image for the city. Three new wells east of the city have been built, each with the capacity to pump up to 1,500 gpm. The supply is transported to the city’s treatment facility via a 20” pipeline, where a filtering tank has been added to the three that exist at the water purification plant.

The California Revolving Fund program disburses low interest loans to address water quality problems associated with discharges from wastewater and water reclamation facilities, as well as from non-point source discharges and for estuary enhancement. This Policy was written to implement the 1987 Amendments to the Federal Clean Water Act which created the State Revolving Fund (SRF) Loan Program. Some of the participants include: (1) the Town of Alpaugh (treatment and collection system), (2) the City of Fresno (treatment plant expansion), (3) the County of Kern (Rexland Acres community sewer collection and transmission system), and (4) Fresno Metropolitan Flood Control District (storm water quality management).

The City of Clovis received AB 303 funding for a proposed project that will include: (1) compiling groundwater recharge basin site characteristics to increase recharge capabilities, (2) constructing groundwater monitoring wells at recharge facilities to better monitor percolation and movement, and (3) creating a Ground Water Information System (data management system) to provide a comprehensive and organized data base for improved groundwater data accessibility and maintenance.

In Kern County, the Kern Water Bank Project will receive Proposition 13 funding to increase the recovery capacity of the Kern Water Bank. The Kern County Groundwater Storage and Water Conveyance Infrastructure Improvement Program will receive Prop 13 funding to provide additional opportunities for Kern County facilities to develop water supplies for ecosystem restoration and provide water to the Environmental Water Account.

Another project receiving Prop 13 funding is the Kern Water Bank River Area Recharge and Recovery Project that would allow the Kern Water Bank Authority to provide as much as 50,000 af/yr of additional water recovery capability. In years when recovery needs are less than recovery capacity, water could be recovered for the Environmental Water Account or other ecosystem restoration needs.

The North Kern Groundwater Storage Project will take advantage of wet year high flows and store them in the groundwater aquifer. This may reduce demands on water supplies from the Delta in dry years.

The Westlands Water District will receive AB 303 funding to investigate increasing water supply, including potential conjunctive use opportunities. This project will include exploratory drilling to evaluate recharge potential along two creeks and to increase the district's knowledge of the water bearing properties at the two sites. The plan is to drill, log, and construct monitoring wells at 45 locations.

In western Fresno County, the Natural Resources Conservation Service (NRCS) is promoting programs that (1) reduce the amount of salts leached to ground water and improve shallow, saline water table conditions with improved irrigation water management, (2) improve the distribution and management of livestock to reduce erosion using prescribed grazing, fencing, and improved watering facilities for livestock, (3) reduce soil salinity in the crop root zone to improve cropland productivity with improved irrigation water management and soil salinity management, (4) reduce the amount of airborne particulates with adjusted timing of agricultural operations, vegetating turn areas, and avoiding tracking soil onto the county roads and (5) reduce sheet and rill erosion on rangeland through improved livestock distribution and production of forage.

The Lake Kaweah Enlargement Project will raise the spillway by 21 feet thereby increasing water storage capacity of Lake Kaweah by 143,000 acre-feet to 183,000 acre-feet or 28 percent. Still a small lake in comparison to some in California, the enlargement project will increase flood protection to downstream communities on the Kaweah Delta river system, especially Visalia. The dam’s spillway crest, a U-shaped cut, is being raised with the installation of "fuse gates." These gate are like large concrete teeth that pop out like fuses if the lake should become so full. Once completed in 2004, farmers should reap immediate benefits because a larger lake will allow longer summer irrigation periods. Additionally, the Tulare Lake bed is less likely to be inundated with flood flows that could halt farming operations. Recreational use will also be enhanced, because even in winter, when the lake is almost empty, it will be large enough to accommodate boating. The federal government is putting up more than half the cost of the $33 million project, the state Reclamation Board is providing $10.1 million, and the local agencies are providing $5.4 million.

The Coordinated Resource Management and Planning (CRMP) groups in the Tulare Lake Basin region include the Panoche and Silver Creek CRMP, the Stewards of the Arroyo Pasajero Watershed CRMP, and the Cantua/Salt Creek Watersheds CRMP. Their aim is to promote watershed health throughout the western Fresno county foothills. The primary concerns in these watersheds are flooding, erosion, sediment transport and the quality of water entering into the San Joaquin River and the California Aqueduct. Some of the water management strategies they employ to address these problems include: stream flow and water quality monitoring programs, re-vegetation of embankments, and implementation of watershed best management practices.

The Kern River Parkway will include a 40-acre multi-purpose recharge lake and recreation area with a permanent 10-acre recharge lake and adjoining playing field that will be surrounded by grass-sloped and tree-shaded seating areas. During extremely wet water years, these open fields (approximately 25 acres) will be flooded and used for groundwater recharge in the spring months. There will also be a new access route to the existing Kern River north bank equestrian trail from the future Jewetta Avenue extension.

Relationship with Other Regions

The Tulare Lake region receives CVP water from the San Joaquin River Region via the Friant-Kern Canal, and imported water from the Sacramento-San Joaquin Delta via the SWP California Aqueduct and the CVP San Luis and Delta-Mendota canals. The economic health of the region is heavily dependent on the continued availability of imported surface water to meet future needs.

Looking to the Future

The counties in the Tulare Lake Region have water agencies that have been proactive for many years. Water from local streams has been developed for agricultural and urban use. In addition, when it became apparent that the groundwater supplies were not sustainable, many agencies worked to get the CVP and SWP approved and completed. The predominant agricultural economy has been slowly transitioning to share with the growing urban economy. New projects have been identified necessary to better manage the local water supplies, adhere to more stringent water quality standards and environmental regulations. The inset figure is a short list of some of the plans and projects ongoing and planned in the region. A comprehensive list can be found in Volume 5 of the Update.

Ongoing Planning Efforts

- Kern County Water Agency Conjunctive Management Program
- Water Agency Exchanges and Transfers
- Kern County Water Agency EWA Sales
- Optimization of Water Conveyance Systems
- Inter-regional Water Storage, Drought Supply Agreements

Regional Planning

An important piece of California's water puzzle is the voluntary transfer of water from one water user to another. A rather brisk business in water transfers has developed within the lower San Joaquin Valley. Local rules allow districts through groundwater banking agreements or other joint water development projects to transfer water.

The San Joaquin Valley Water Coalition meets to discuss common issues related to water supply, water quality, water management to ensure the distribution of a sustainable water.

Some factors that must be considered in the regional planning process are:

- Population Growth
- Groundwater Overdraft and Associated Problems

- Reliability of Supplies in Foothill and Mountain Communities
- Reliability of Supplies for Wildlife and the Environment
- Transfers and Exchanges and their Effects
- Ground Water Banking Programs
- Ground Water Quality, issues particularly for drinking and municipal use

Several projects resulting from this planning process in the region are listed in the following.

Pond-Poso Improvement District Project Enhancements

The Pond-Poso Improvement District works to investigate, perform activities and construct infrastructure necessary to benefit the ground water resource in the north-central area of Kern County. This activity has recently qualified for Proposition 204 funds. A primary goal is to encourage local ground water users to begin using surface water whenever available in-lieu of groundwater. This enhances the local ground water basin by foregoing current pumping. The project is being undertaken by the Semitropic Water Storage District.

Pioneer Groundwater Recharge and Recovery Project

The funding obtained from Proposition 204 will be used to enhance the operation of the Kern Water Bank. This operation entails physical and management strategies to maximize recovery of recharged groundwater in the Pioneer Project for use by project participants. The project has the potential to reduce dry year demands for water from the Delta. The Kern County Water Agency is the recipient.

Pond - Shafter - Wasco Irrigation and Water Use Efficiency

This effort is targeting agricultural irrigation practices in Kern County. The project's goals are: 1) to implement a Total Farm Management Program in the San Joaquin Valley area of Kern County, 2) Reduce PM-10 levels on 50 percent of the permanent crops harvested in the valley, 3) Reduce agricultural water use by 15 percent over the next 5 years through physical changes to irrigation systems and irrigation management, 4) Increase wildlife habitat by 30 percent over the next 5 years, and 5) Educate local growers about new or proven techniques in water, air, nutrient, and pesticide management. The Pond-Shafter-Wasco Resource Conservation District in conjunction with the Natural Resources Conservation Service are leading this project.

Kern County Groundwater Storage and Water Conveyance Infrastructure Improvement Program

Proposition 13 funding will be used to further implement activities and programs that will provide additional opportunities for the Kern County water community to enhance and develop facilities that will provide water supplies for local uses and potentially increase opportunities for ecosystem restoration. In addition, a goal is to take advantage of all opportunities to increase the sale of water to the Environmental Water Account. The Kern County Water Agency is the grantee.

White Wolf Basin Ground Water Banking Project

The White Wolf Basin is a smaller, somewhat isolated, ground water basin in the southeastern corner of Kern County. The Wheeler Ridge-Maricopa Water Storage District is evaluating development of a ground water banking project in this aquifer. Water would be imported for storage from the California Aqueduct. Recovered water could be conveyed back to the aqueduct, or introduced into the district's distribution system and exchanged for SWP water. Pilot ground water wells are being constructed in order to better understand the underlying geology of this basin.

South Valley Water Management Program

The southern end of the San Joaquin Valley has water conveyance systems that are interconnected, especially in Kern County. During wet years water supplies may become available for short durations from any of a number of sources (i.e., San Joaquin River, Kings River, Kern River.) The Kern County Water Agency, and several south valley water districts, are evaluating the potential to coordinate supplies and deliveries among districts so that mutually beneficial results are obtained. Most importantly, it is hoped that water supply availability to the region will be maximized.

Rosedale-Rio Bravo Water Storage District Banking Program

The Rosedale-Rio Bravo Water Storage District (RRB) is developing a banking project with a maximum storage of 500,000 acre-feet. Recharge basins and recovery wells are being constructed. Generally, RRB will store water for others in wet years via unbalanced exchanges (i.e., 2-for-1 exchange) and return water in drier years either by delivery of its SWP or Kern River water supplies, or by pumping wells if insufficient exchange capability exists.

Kern Delta Water District/Metropolitan Water District Joint Banking Project

Kern Delta Water District is developing a banking partnership with the Metropolitan Water District whereby MWD will store water within Kern Delta in wet years and recover the water during drier years. The project is conceptually similar to the joint Arvin-Edison/Metropolitan Water District Program. The program contemplates storing a maximum of 250,000 acre-feet of water for MWD.

Additional long-term programs and activities involved in future options being considered in the region include:

- Increased Agricultural Water Use Efficiency
- Increased Urban Water Use Efficiency
- Water Conservation Programs/Activities
- Land Retirement
- Temporary Fallowing
- The Kern Water Bank and Similar Projects
- SWP Water Supply Augmentation
- CVP Supply Augmentation
- Mid-Valley Canal or Similar Project
- Demand Reduction
- Short-Term Water Transfers
- Gray Water Use
- Water Recycling.
- Local Conjunctive Use Programs
- Ground Water Reclamation
- Reuse of Brackish Agricultural Drainage Water

Water Portfolios for Water Years 1998, 2000 and 2001

Water Portfolio - Water Year 1998

California weather and water supplies were impacted by another El Nino event during 1997-1998 water year. The previous El Nino year was 1991-1992. El Nino storms did not begin earnestly until January

1998, upon arriving they raised havoc on a number of crops. Of California's 58 counties, 42 were declared major disaster areas.

As a result of the very wet weather, agriculture throughout California experienced delayed crop planting, as well as damaged produce. Consumers felt the impact in their pocket books through high supermarket prices for California vegetables. Producers had difficulty getting into their fields because of the prolonged wet soil conditions. Normal farming practices, such as spraying, pruning, and tying vines were delayed. Needless to say, the quality of many crops was below normal. Fortunately for late developing crops, the fall weather cooperated with clear skies and good temperatures, allowing the majority of crops to be harvested with no significant additional weather problems.

Watershed runoff was well above normal, as the San Joaquin and Kings rivers averaged about 170 percent of normal, the Kaweah River about 196 percent and the Kern River was about 224 percent.

Total irrigated acreage in the region rises and falls depending on surface water supply availability in any particular year from local and imported sources. The 1998 total irrigated acreage was 3.214 million acres. The trend in individual crop acreages is towards higher value commodities such as fruits, tree nuts and vegetables, while the acreage of field crops has been declining. Acreage of wine grapes has been rapidly growing, and almond acreage also continued its steady trend upward.

The dairy industry continued its growth in 1998, particularly in Tulare County, which is now the top milk-producing county in the nation. Alfalfa acreage in the Tulare Lake region exceeded 360,000 acres in 1998, up from 279,600 acres reported in 1995. Corn acreage has risen even faster than alfalfa, exceeding 255,000 acres in the region in 1998, driven by the increasing demand from the dairy industry.

Cotton acreage was down substantially due primarily to weather related problems created by the El Nino event, decreasing to 655,000, a 35 percent decrease from1995. Thus, growers continued the trend of converting field crop land to almond/pistachio orchards in an effort to provide better long-term profits. A combined almond/pistachio acreage of 245,700 acres was 32 percent higher than the acreage reported in 1995.

The El Nino weather patterns generated storms provided an extra source of water, filling soil profiles and reducing early season ETAW, consequently, less applied water was needed compared to most years. The total agricultural applied water estimated for the Tulare Lake Region was 7 million acre-feet (MAF), 2.7 MAF less than estimated year 2000 applied water. The regional average AW was 2.2 af/ac.

The total ETAW in 1998 in the Tulare Lake Region was 29 percent (2.1 MAF) less than the 2001 estimated value and 28 percent (2 MAF) less than year 2000 ETAW. The regional average ETAW was 1.6 af/ac. Individual crop ETAW amounts vary due to differences in rainfall, growing season, soil texture and rooting depths.

Total urban applied water use (including residential, commercial, industrial, and landscape) in the region totaled 535,212 af, 16 percent less than 2000. Urban water use accounted for about 7 percent of the total applied water in the region. Population for the region in 1998 was 1,904,400, 9.6 percent more than 1995. Total ETAW for the year was about 187,324 af and the regional average percapita water use was 249 gallons per day.

Total environmental demand (instream, wild & scenic, and refuges) for the region was about 3.2 maf acre-feet. This accounts for 30 percent of total uses. This includes water that is reserved for instream and wild and scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 63,100 af.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 12.4 maf.

Water Portfolio - Water Year 2000

The weather for water year 1999-2000 in the Tulare Lake Region was very close to long-term average values. Rainfall amounts were somewhat less than average in the southern areas of the basin (Bakersfield-81 percent) and somewhat higher than average in the northern areas of the basin (Fresno 120 percent). The San Joaquin and Kings rivers runoff volumes averaged about 101 percent of normal, the Kaweah River about 87 percent and the Kern river about 70 percent.

Acreage increased only slightly from 1998 to 2000 within the region to 3.219 million acres. The largest crop acreage change was in cotton, which increased 10.7 percent to 725,300 acres in 2000. Cotton prices continued to be low, however, while grower production costs have been rising. The 2000 combined almond and pistachio acreage of 257,000 was 11,200 acres (4.6 percent) higher than in 1998. Corn acreage, primarily for silage, declined 10 percent.

The total agricultural applied water in 2000 for the Tulare Lake Region was 9.7 MAF, a significant 38 percent higher than the 1998 applied water. This large difference illustrates the degree to which weather, particularly wet and cool conditions, can have on irrigation demand and acreage. 1998 was a very wet and cool (low evaporative demand) year, reducing irrigation demand dramatically. The regional average applied water was 3.0 af/ac.

The total 2000 ETAW in the Tulare Lake region was about 2 MAF (38 percent) higher than that of 1998. The regional average ETAW was 2.2 af/ac.

The dairy industry continued its strong growth. New record highs were set for the number of milk cows and milk production. In 2000, California led the nation in total milk production with a record 32.2 billion pounds, representing a 6 percent increase from the previous year.

In 2000, total urban applied water for the region was 637,716 af, which was 16 percent higher than the total applied water for 1998. Urban water use accounted for over **5** percent of the total applied water in the region. Average per capita water use was about 288 gallons per day. Total population in 2000 within the region was around 1,973,000, an increase of 3.6 percent over the 1998 population. Total urban ETAW for the year was about 223,201 af.

Total environmental demand (instream, wild & scenic, and refuges) for the region was about 1.4 maf. This accounts for 12 percent of total uses. This includes water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 73,800 af.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 12.8 maf.

Water Portfolio - Water Year 2001

The water year started out cooler than normal with cumulative rainfall below average through most of January. However, large scale weather patterns changed significantly as February approached and a series of Pacific storms moved in the state, helping to bring precipitation totals closer to normal. Rainfall amounts were slightly less that average for the water year in the region with totals about 93 percent of average in both Fresno and Bakersfield.

Except for a thunderstorm in April resulting in significant high wind, hail, and rainfall, crop development was generally normal throughout the remainder of the growing season.

Less than ample precipitation in local watersheds resulted in runoff for the year being below average resulting in below average surface water supplies. San Joaquin River, Kings River and Kaweah River runoff was about 71 percent while Kern River runoff was 54 percent.

Total irrigated agricultural acreage declined 9.6 percent (126,200 acres) in 2001 to 3.093 million acres in 2000. The price for milk and cream commodities rose fourteen percent in 2001 and pushed Tulare County into the leading agricultural commodity gross value position among all California counties surpassing Fresno County which had held the number one position for many years. Cotton acreage dropped 85,900 acres from 2000 influenced primarily by the drop in price of the upland variety. Sugar beets acreage continued its multiyear downward spiral showing 47 percent less acreage than 2000. The move into wine grapes the past several years leveled out as the market reached a point of saturation and prices began to weaken. The acreage of raisin grapes dropped almost 20 percent in 2001 responding to the dramatic drop in price over the past couple of years. Raisin growers were receiving over $1,000 per ton in 1999 compared to about $525 per ton in 2001. The almond/pistachio acreage followed the upward trend of previous years increasing over ten percent.

The total agricultural applied water in 2001 for the Tulare Lake region was 9.9 MAF, 42 percent higher than the 1998 and 2.6 percent higher than 2000 applied water. This is an average unit rate of 3.2 af/ac. The total 2001 ETAW in the Tulare Lake region was about 41 percent (2.1 MAF) higher than that of 1998 and two percent (158 TAF) higher than 2000.

The total urban applied water in 2001 for the region was 663,931 af, which was 194 percent higher than the total applied water for 1998 and 4 percent higher than 2000. . Urban water use accounted for about 5.5 percent of the total applied water in the region. Average per capita water use about 295 gallons per day. Total population in the region for the 2001, was 2,012,400, (an increase of 2 percent higher than 2000 population and 5.7 percent higher than 1998). Total urban ETAW for the year was around 232,376 af.

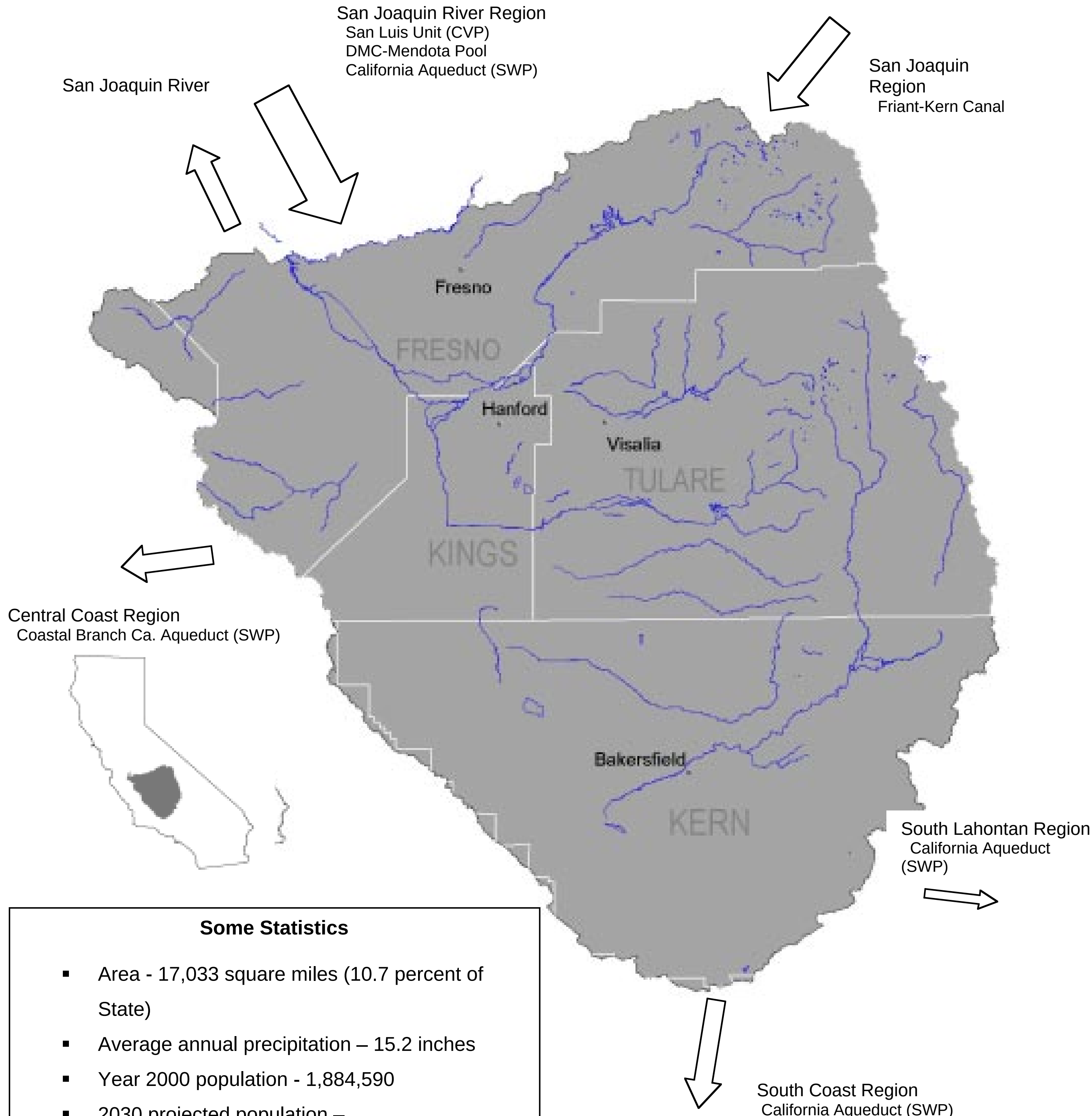
Total environmental demand (instream, wild & scenic, and refuges) for the region was about 1.04 maf. This accounts for 9 percent of total uses. This includes water that is reserved for instream and wild & scenic river flow, but that can be later used as a supply by downstream users. Refuge supplies, which are supplies applied directly onto wildlife refuges, accounts for 76,300 af.

Total supplies, including local and imported (CVP & SWP) surface water, groundwater, and reuse, amounted to 12.3 maf.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001
- Fresno Metropolitan Water Resources Management Plan Phase III Report Implementation Plan Excerpts, City of Fresno Planning Library Web site, www.fresno.gov/planning_library/default.asp
- Westlands Water District Web site, www.westlandswater.org
- Various articles, Fresno Bee newspaper

Figure 8-1
Tulare Lake Hydrologic Region



Some Statistics

- Area - 17,033 square miles (10.7 percent of State)
- Average annual precipitation – 15.2 inches
- Year 2000 population - 1,884,590
- 2030 projected population –
- Total reservoir storage capacity - 2,046 TAF
- 2000 irrigated agriculture - 3,083,000 acres

Table 8-1
Tulare Lake Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	27,306	12,693	11,564
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	3,824	5,579	3,785
Total	**31,130**	**18,272**	**15,349**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	5,401	7,427	7,591
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	2,392	1,614	1,295
Statutory Required Outflow to Salt Sink	0	0	0
Additional Outflow to Salt Sink	477	587	538
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	21,990	10,539	10,243
Total	**30,260**	**20,167**	**19,667**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	438	-57	-141
Change in Groundwater Storage **	432	-1,838	-4,177
Total	**870**	**-1,895**	**-4,318**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	8,437	10,725	10,723

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =

intentional recharge + deep percolation of applied water + conveyance deep percolation - withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 8-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	Tulare Lake 1998 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Tulare Lake 2000 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Tulare Lake 2001 (TAF) Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	27,305.9				12,692.9				11,563.6				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		3,623.3				2,275.6				1,713.4			PSA/DAU
10	Local Imports		-				-				-			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		1,820.1				2,272.3				1,790.5			PSA/DAU
12	Other Federal Deliveries		-				-				-			PSA/DAU
13	State Water Project Deliveries		1,223.0				1,955.5				849.3			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		-				-				-			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		-				-				-			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		3.1				2.5				2.0			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		1,347.8				1,928.4				2,075.5			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		27.3				29.7				34.6			PSA/DAU
c	Deep Percolation of Applied Water - Urban		348.1				414.5				431.6			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		3,205.0				1,331.1				964.0			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	865.3				708.7				652.2				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	2,535.7				5,024.7				6,974.5				REGION
Withdrawals	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	1,303.6				652.2				511.4				PSA/DAU
31	Groundwater Recharge-Contract Banking		99.8				167.4				-3.9			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				39.3				38.5				34.2	REGION
b	Evaporation from Reservoirs				232.9				233.8				190.6	REGION
36	Ag Effective Precipitation on Irrigated Lands		-				-				-			REGION
37	Agricultural Use		7,839.2	6,491.4	5,677.4		10,013.0	8,084.6	7,762.8		9,983.1	7,907.6	7,860.0	PSA/DAU
38	Wetlands Use		63.1	35.8	32.8		73.8	44.1	41.5		76.3	41.7	38.9	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		101.6				121.1				126.3			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		155.1				185.1				192.7			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		106.9				127.7				132.8			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		64.3				76.4				79.7			PSA/DAU
40	Urban Commercial Use		37.5				44.6				46.3			PSA/DAU
41	Urban Industrial Use		53.4				63.8				66.4			PSA/DAU
42	Urban Large Landscape		16.0				19.2				19.8			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		-	-	-		-	-	-		-	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		3,205.0	-	-		1,331.1	-	-		964.0	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				5,181.4				7,162.0				7,320.4	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				32.8				41.5				38.4	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				187.0				223.3				232.4	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				-				-				-	PSA/DAU
50	Urban Waste Water Produced	-				-				-				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				10.6				12.8				13.3	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				442.5				482.0				382.1	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				477.3				587.1				537.5	PSA/DAU
b	Return Flows to Salt Sink - Urban				-				-				-	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				0.5	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				-				-				-	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	3,824.3				5,579.4				3,784.6				REGION
56	Regional Exports	2,391.7				1,614.4				1,295.0				REGION
59	Groundwater Net Change in Storage	432.2				-1,837.5				-4,176.8				REGION
60	Surface Water Net Change in Storage	438.3				-56.5				-140.8				REGION
61	Surface Water Total Available Storage	2,046.1				2,046.1				2,046.1				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

Table 8-3
Tulare Lake Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	16.0			19.2			19.8		
Commercial	37.5			44.6			46.3		
Industrial	53.4			63.8			66.4		
Energy Production	0.0			0.0			0.0		
Residential - Interior	208.5			248.7			259.1		
Residential - Exterior	219.4			261.4			272.4		
Evapotranspiration of Applied Water		187.0	187.0		223.3	223.3		232.4	232.4
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	10.6			12.8			13.3		
Conveyance Losses - Evaporation		10.6	10.6		12.8	12.8		13.3	13.3
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.7			2.9			0.5		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**546.1**	**197.6**	**197.6**	**653.4**	**236.1**	**236.1**	**677.8**	**245.7**	**245.7**
Agriculture									
On-Farm Applied Water	7,006.9			9,677.6			9,933.8		
Evapotranspiration of Applied Water		5,181.4	5,181.4		7,162.0	7,162.0		7,320.4	7,320.4
Irrecoverable Losses		477.3	477.3		587.1	587.1		537.5	537.5
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	753.7			787.9			590.5		
Conveyance Losses - Evaporation		423.8	423.8		468.3	468.3		380.0	380.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	832.3			335.4			49.3		
GW Recharge Evap + Evapotranspiration		18.7	18.7		13.7	13.7		2.1	2.1
Total Agricultural Use	**8,592.9**	**6,101.2**	**6,101.2**	**10,800.9**	**8,231.1**	**8,231.1**	**10,573.6**	**8,240.0**	**8,240.0**
Environmental									
Instream									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	3,205.0			1,331.1			964.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	63.1			73.8			76.3		
Evapotranspiration of Applied Water		32.8	32.8		41.5	41.5		38.4	38.4
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		3.1	0.0		2.5	0.0		2.5	0.5
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	63.1	35.9	32.8	73.8	44.0	41.5	76.3	40.9	38.9
Total Environmental Use	**3,268.1**	**35.9**	**32.8**	**1,404.9**	**44.0**	**41.5**	**1,040.3**	**40.9**	**38.9**
TOTAL USE AND LOSSES	**12,407.1**	**6,334.7**	**6,331.6**	**12,859.2**	**8,511.2**	**8,508.7**	**12,291.7**	**8,526.6**	**8,524.6**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	3,623.3	3,623.3	3,621.6	2,275.6	2,275.6	2,274.7	1,713.4	1,713.4	1,712.6
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	1,820.1	1,820.1	1,819.3	2,272.3	2,272.3	2,271.4	1,790.5	1,790.5	1,789.7
Other Federal Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SWP Deliveries	1,223.0	1,223.0	1,222.4	1,955.5	1,955.5	1,954.7	849.3	849.3	848.9
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	-331.7	-331.7	-331.7	2,007.8	2,007.8	2,007.8	4,173.4	4,173.4	4,173.4
Artificial Recharge	814.3			324.7			48.9		
Deep Percolation	2,053.1			2,692.2			2,752.2		
Reuse/Recycle									
Reuse Surface Water	3,205.0			1,331.1			964.0		
Recycled Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL SUPPLIES	**12,407.1**	**6,334.7**	**6,331.6**	**12,859.2**	**8,511.2**	**8,508.7**	**12,291.7**	**8,526.6**	**8,524.6**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 8-2
Tulare Lake Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

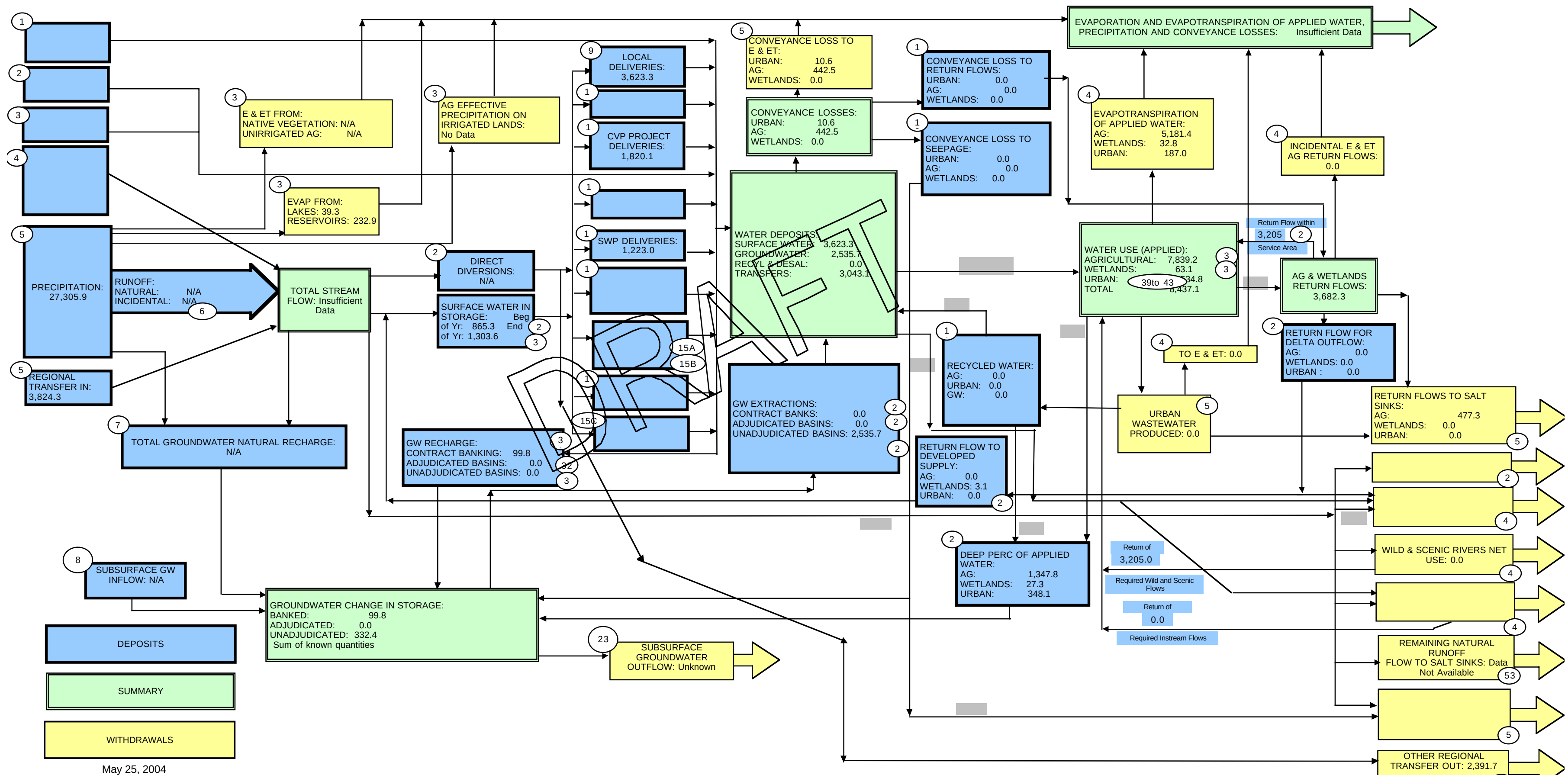


Figure 8-3
Tulare Lake Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

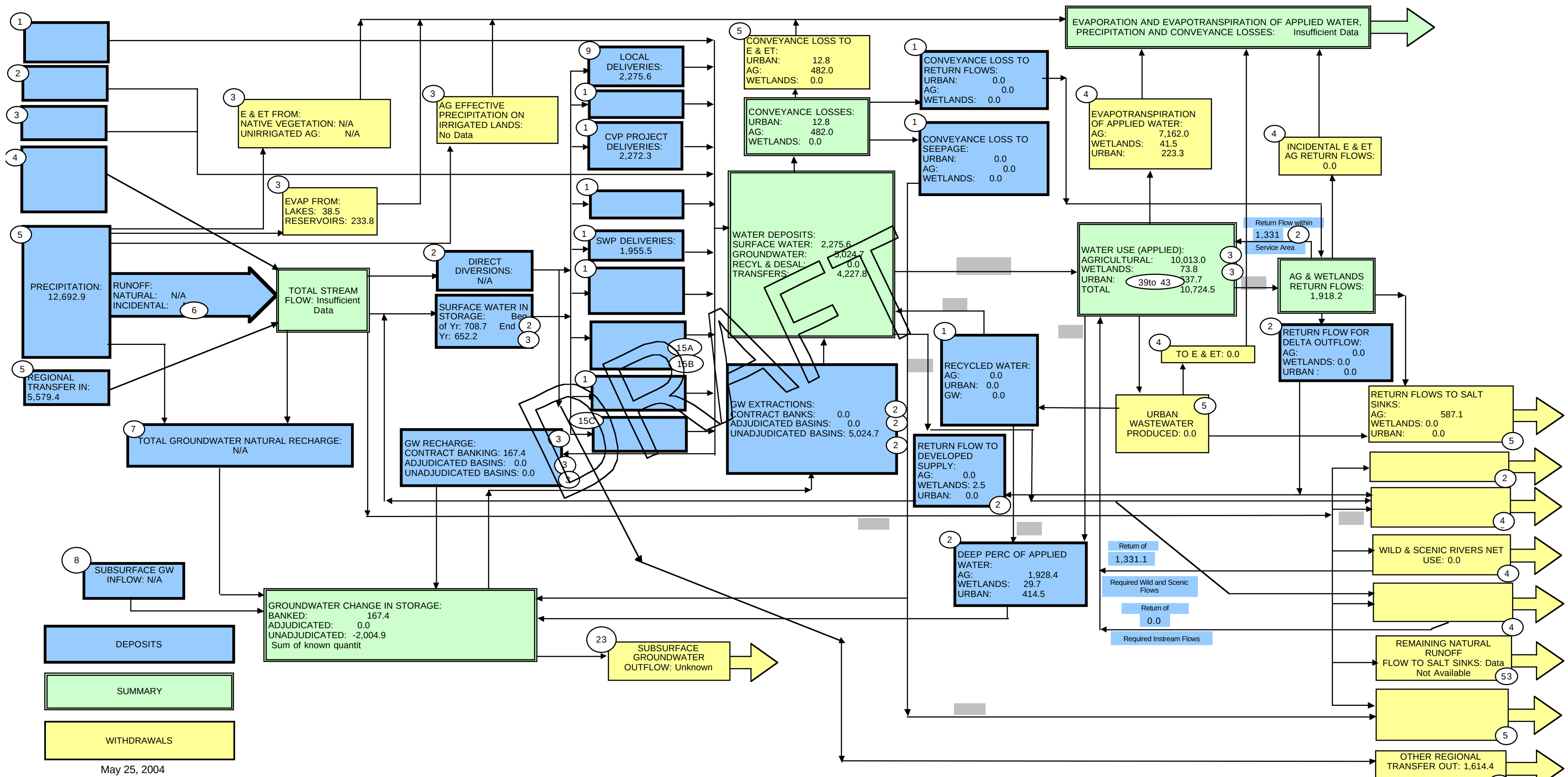
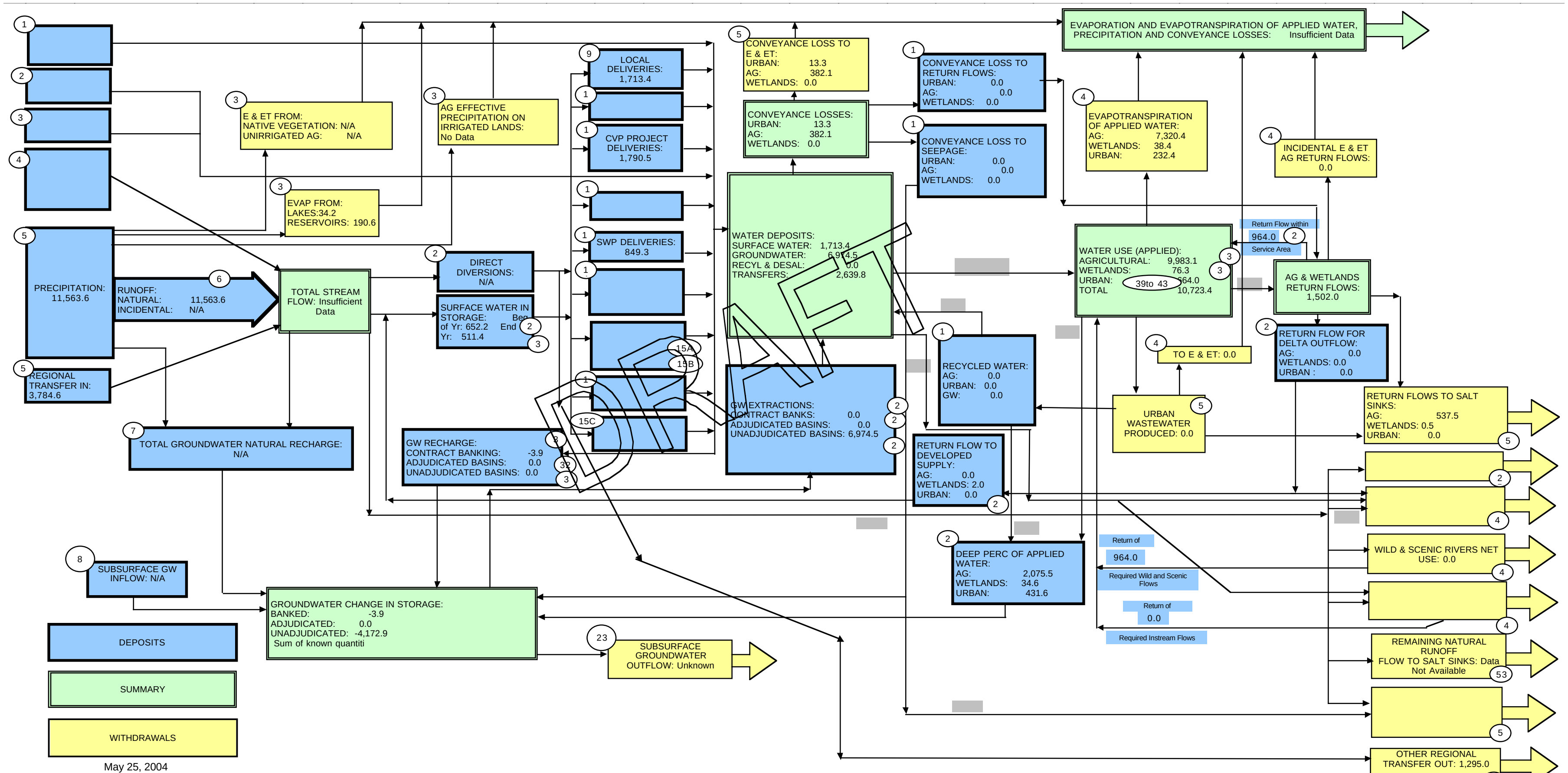


Figure 8-4
Tulare Lake Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 9. North Lahontan Hydrologic Region

Setting

The North Lahontan Hydrologic Region forms part of the western fringe of the Great Basin, a large landlocked area that includes most of Nevada and northern Utah. It stretches about 270 miles from the Oregon border to the southern boundary of the Walker River drainage in Mono County (Figure 9-1). The region covers 6,080 square miles, about 4 percent of California's total area. The region includes portions of Modoc, Lassen, Sierra, Nevada, Placer, El Dorado, Alpine, Tuolumne, and Mono Counties. At its widest part, the region measures about 60 miles across; it narrows to scarcely 2 miles in southern Sierra County. Major rivers of the region flow into Nevada. The mountain crests forming the western boundary of the region range up to elevation 11,000 feet.

Climate

The region's climate is characterized by dry summers with the exception of occasional scattered thundershowers. Winter precipitation ranges from less than 5 inches in the valleys of Eastern Modoc and Lassen Counties to about 30 inches in the Walker Mountains to more than 60 inches in the Sierra Nevada that form the western boundary of the area and drain into the Truckee and Walker River Basins. Most of the winter precipitation consists of snow in the valleys, which usually melts between storms. Snow generally accumulates in mountain areas above 5,000 feet over the winter months. The snow becomes a source of water for the late spring and summer months.

Population

Only about 99,000 people, a quarter of one percent of California's population, live in the North Lahontan Region. The principal population center is Susanville, the county seat of Lassen County.

Land Use

Much of the region is national forest and lands under the jurisdiction of the Bureau of Land Management. Cattle ranching is the principal agricultural activity with pasture and alfalfa being the dominant irrigated crops. Commercial crop production is limited because of the short growing season. Although growing seasons vary considerably each year the mountain valleys where the majority of the crops are grown are usually frost free from late May to mid-September or about 120 days.

Tourism and recreation are the principal economic activities in the Truckee-Tahoe area and the surrounding mountains. On a typical summer day, the number of visitors within the Tahoe Basin may equal the number of full-time residents. The principal consumptive use of applied water used for the for environment are those of State Wildlife Areas around Honey Lake which provide important habitat for waterfowl and several threatened or endangered species, including the bald eagle, sand hill crane, bank swallow, and peregrine falcon.

Water Supply and Use

Natural runoff of the streams and rivers averages around 2 million acre-feet per year, of which only about one-quarter is in the drier northern portion. The largest rivers in the region and their approximate average runoff at the Nevada line are: the Truckee with 600,000 acre-feet; the Carson, 400,000 acre-feet; and the

Walker, 500,000 acre-feet. The Susan River is the only major stream in the northern half of the region; its annual discharge at Susanville averages around 60,000 acre-feet.

The Truckee, Carson, and Walker Rivers are governed in large part by existing federal court water rights decrees administered by court-appointed water masters. The interstate nature of the rivers, combined with the long history of disputes over water rights, has created a complex system of river management criteria. On the Carson River for example, it took the federal court 55 years to sort out the water rights and issues of the Alpine Decree, which governs operation of the river today.

Much of the supply from the Truckee, Carson, and Walker rivers is reserved for use by Nevada interests under various water rights settlements and agreements. Most locally developed water supplies are from groundwater or small surface water diversions, with storage provided by outlet dams constructed on natural lakes. Federal water storage projects in the region include Stampede Reservoir, Boca Reservoir, and Prosser Creek Reservoir, constructed primarily to provide water supply for Nevada urban and agricultural water use, downstream flood protection, protection of threatened and endangered species and local recreation. The U.S. Army Corps of Engineers also completed the Martis Creek Dam in 1971 to provide additional flood protection for the Reno-Sparks area.

Land irrigated by surface water generally has a higher than normal applied water rate; when possible a portion of the spring runoff is spread on the soil to deep percolate and recharge groundwater basins rather than being allowed to flow to saline lakes and evaporate. Since most of the surface water irrigation operates with non-firm water supply; irrigated acreage and the length of time irrigation water is available fluctuates annually. The crop most subject to these changes is irrigated pasture. Even though acreage is some areas can remain relatively stable, the length of the irrigation season is often shortened since runoff generally decreases as summer progresses.

There are 24 groundwater basins and two subbasins recognized in the region. Thirteen of these basins are shared with Nevada and one with Oregon. These basins cover approximately 1,033,240 acres (1,610 square miles) or about 26 percent of the entire region. Groundwater storage capacities are available for only six of the 26 basins/subbasins and the combined storage for these basins is estimated at between 23.5 to 24.0 maf. Although the groundwater basins were delineated based on mapped alluvial fill, much of the groundwater produced in many of them actually comes from underlying fractured rock aquifers. This is particularly true in the volcanic areas of Modoc and Lassen Counties where, in many basins, volcanic flows are interstratified with lake sediments and alluvium. Wells constructed in the volcanics commonly produce large amounts of groundwater, whereas, wells constructed in fine-grained lake deposits produce less. Because the thickness and lateral extent the of the hard rocks out of the defined basin are generally not known, actual groundwater in storage in these areas is unknown.

About 5,000 acre-feet of reclaimed wastewater are exported out of the Tahoe Basin by South Tahoe Public Utility District for agricultural use in the Carson River watershed. Truckee Tahoe Sanitation Agency treats wastewater from the Tahoe Basin and returns about 4,000 acre-feet (which is used downstream in Nevada and does not contribute to California’s supplies). The Susanville Sanitary District reclaims over 3,000 acre-feet of wastewater for use on nearby irrigated pasturelands.

The principal consumptive uses of water for environmental uses in the region are those of State Wildlife Areas around Honey Lake. The Honey Lake Wildlife Area in southern Lassen County consists of the

4,271-acre Dakin Unit and the 3,569-acre Fleming Unit. The two units provide important habitat for several threatened or endangered species, including the bald eagle, sand hill crane, bank swallow, and peregrine falcon. This wildlife area has winter storage rights from the Susan River from November 1 until the last day of February. The HLWA also operates eight wells, each producing between 1,260 and 2,100 gallons per minute. In an average year, the HLWA floods 3,000 acres by March 1 for waterfowl brood habitat.

In 1989, the California department of Fish and Game purchased the 2,714-acre Willow Creek Wildlife Area in Lassen County to preserve existing wetlands and to increase the potential for waterfowl production and migration habitat. About 2,000 acres are wetlands and riparian habitats. The endangered bald eagle and sand hill crane also inhabit this area. In addition to the Honey Lake and Willow Creek Wildlife Areas, DFG operates the Doyle Wildlife Area, also in the Honey Lake Basin. This wildlife area is persevered as dryland winter range for deer and requires less water than the Honey Lake or Willow creek areas.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table more water flows into Nevada than is consumptively used in the region.

State of the Region

Challenges

Although Lake Tahoe contains over 122 million acre-feet of pristine mountain water (*nearly three times the capacity of California's more than 1,300 reservoirs*), much of the North Lahontan Region is chronically short of water. In the northern portion of the Region, drought is a way of life for agriculture; irrigation continues as long as water is available and then stops. During dry years many areas with little or no storage may only have surface water available for a short period early in the season and then may only be able to irrigate a limited acreage if they do not supplement their surface water supply with groundwater. In Modoc and Lassen Counties some groundwater well pumping capacities diminish very rapidly even during the first year of a drought. While the Truckee River Operating Agreement has the potential to settle 50 years of disputes over Truckee and Carson River waters, the execution and implementation of that agreements will require considerable effort in the coming years.

The States of California and Nevada have been participating in a confidential mediation that could affect water users in both states. The primary issue of concern is the declining level of Walker Lake in Nevada and the resulting impact on the lake's fishery. The water level at Walker Lake has declined from an elevation of about 4,080 feet in 1882 to 3,941 feet in 2003; salinity has increased during the same period from about 2,500 mg/L TDS to 13,200 mg/L TDS. To maintain lake salinity at the current level, about 33 taf/yr more inflow is needed. Other issues that could also affect existing water users are the potential tribal water rights claims far downstream on the Nevada side of the basin.
Water quality in the region is generally very good but many communities face specific water quality problems. These include groundwater contamination from septic tank discharges in urban subdivision areas such as Susanville and Eagle Lake, and MTBE contamination in South Lake Tahoe. Drinking water quality has also become a greater issue for many surface water systems around Lake Tahoe, forcing many of the smaller private systems to consolidate or change ownership because they are unable to afford the new monitoring and treatment regulatory requirements. Even South Tahoe Public Utility District, the

largest water purveyor in the basin, is experiencing some difficulty in meeting these requirements. The abandoned Leviathan Mine, a Superfund site, impacts local creeks with acid mine drainage. The top water quality issues emerging from the Lahontan RWQCB's 2003 Triennial Review included revising waste discharge prohibition affecting piers in Lake Tahoe, and the sodium standards for Carson and Walker Rivers and their tributaries.

Lake Tahoe, in fact, is the subject of its own chapter in the region's basin plan, and receives many specific and extraordinary water quality protections. The Porter-Cologne Water Quality Control Act bans the discharge of domestic wastewater from California in the Lake Tahoe basin; the same ban is in Nevada by executive order, resulting in the export of all domestic wastewater from the basin. Discharges of industrial wastewater, wastes from boats and marinas, food wastes, and solid waste are also prohibited in the Tahoe basin. Lake Tahoe's clarity has declined as development has increased around the shoreline, increasing the sediment load and nutrients reaching the lake and its tributaries. Nutrients, such as nitrogen and phosphorous used in landscaping fertilizers, can enter the lake via storm water runoff, promoting growth of algae and thereby reducing clarity. Nitrogen pollution in the basin is primarily due to vehicles, while phosphorous is mostly derived from erosion and dust (phosphate-based detergents are banned). Roads and road maintenance activities, including snow removal and deicing, are restricted because of erosion and other impacts. Previous use of salt for road de-icing by Caltrans had resulted in the killing of trees and plants that prevent erosion and thus sediment from reaching the lake. Forest fires, grazing, and logging—and subsequent erosion and runoff of nutrients—also present a threat to the lake's water clarity. Agricultural use of pesticides in the Lake Tahoe basin is prohibited, and the Tahoe Regional Planning Agency has banned the use of two-stroke engines on Lake Tahoe to prevent contamination from gasoline components such as benzene and MTBE. Other restrictions on land development and disturbance, as well as programs involving pollution offsets, BMP retrofits, and land purchase, are also utilized to preserve and improve lake water quality. Lake Tahoe is extensively monitored by the UC Davis Tahoe Research Group.

California local interests in the northern part of the region have been apprehensive about Reno area's aggressive quest for additional water supplies. In the late 1980's, the Silver State Plan triggered concerns as far north as Modoc County (*Over 150 miles north of Reno*). The plan envisioned constructing a pipeline north nearly to the Oregon border to tap groundwater basins, some of which extend across the California-Nevada line. More recently, the proposed Truckee Meadows Project generated concern about depletion of groundwater supplies.

Tahoe's clarity has been declining as increasing development around the shoreline increase the sediment load and nutrients reaching the lake. Nutrients, such as nitrogen and phosphorous used in lawn or golf course fertilizers, can enter the lake in the form of storm water runoff. Nutrients promote growth of algae, reducing clarity. Clarity of the lake is measured by the depth to which a Secchi disk, a small plastic disk of specific size, is visible. In the late 1960s, average Secchi disk visibility in Lake Tahoe was about 100 feet; now the figure is closer to 70 feet

Accomplishments

Years of disputes over the waters of the Truckee and Carson rivers led to congressional enactment of the Truckee-Carson-Pyramid Lake Water Rights Settlement Act in 1990. The act makes an interstate allocation of the waters between California and Nevada, provides for the settlement of certain Native American rights claims, and provides for water supplies for specified environmental purposes in Nevada.

The act allocates to California: 23,000 acre-feet annually in the Lake Tahoe Basin; 32,000 acre-feet annually in the Truckee River Basin below Lake Tahoe; and water corresponding to existing water uses in the Carson River Basin. Provisions of the Settlement Act, including the interstate water allocation, will not take effect until several conditions are met, which includes the Truckee River Operation Agreement.

Negotiation of a proposed Truckee River Operating Agreement (TROA) and preparation of an EIR/EIS for the TROA began in 1991. The draft EIR/EIS was released for public review in 1998 and was completed in 1999. PL101-618 settled years of dispute over Truckee and Carson River waters by making an interstate allocation between California and Nevada. It also settled certain tribal water rights claims and provided for water supplies for specified environmental purposes in Nevada. When executed, the TROA would establish river operations procedures to meet water rights on the Truckee River and to enhance spawning flows in the lower Truckee River for cui-ui and Lahontan cutthroat trout. TROA would provide for management of water within the Truckee Basin in California, including instream flow requirements and reservoir storage for fishery and recreation uses, and would include procedures for coordinating releases and exchanges of water among the watershed's reservoirs. TROA would become the exclusive federal regulations governing releases of water stored in Lake Tahoe, Martis Creek, Prosser Creek, Stampede, and Boca Reservoirs. The agreement would provide an accounting procedure for surface and groundwater diversions in California's part of the Truckee Basin and would establish criteria to minimize short-term reductions in river flow potentially caused by future well construction near the river. In 1993, an agreement was signed by Sierra Pacific Power Company, Washoe County Water Conservation District, and Sierra Valley Water Company settling a dispute about when the water company was required to stop diverting water from the Little Truckee River. This agreement, which resolves disputes that had often occurred during droughts, is being incorporated into the proposed TROA. Issues of concern to California include: (1) surface and ground water allocations to the states, including accounting procedures such as water used for snowmaking at the local ski resorts, and (2) operation of the Lake Tahoe Dam at Tahoe City and provisions for pumping water from the lake when sufficient water cannot be released during drought events.

Programs to manage Lake Tahoe water quality by regulating development and preventing pollutants from reaching the lake are being implemented at the federal, state, and local levels. The Tahoe Regional; Planning Agency, a bistate agency created by Congress, sets regional environmental standards, issues land use permits (*Including conditions to protect water quality*), and takes enforcement actions throughout the basin. TRPA's regional plan provides for achievements and maintenance of environmental targets by managing growth and development. In addition to its regulatory activities, TRPA carries out a capital improvement program to repair environmental damage done before its regional plan was adopted. TRPA has identified nearly $500 million in capital improvements needed to achieve environmental targets. Federal, state, and local governments have invested nearly $90 million in erosion control, storm water drainage, stream zone restoration, public transit, and other capital projects. The USFS's Lake Tahoe Basin Management Unit controls over 70 percent of the land in the Tahoe Basin. The LTBMU has implemented a watershed restoration program and a land acquisition program to prevent development of sensitive private lands. In recent years, federal and state agencies have increased funding to protect the environment of Lake Tahoe. The State of Nevada approved a $20 million bond measure to perform erosion control and other measures on the east side of the lake. In California, Proposition 204 provides $10 million in bond funds for land acquisition and programs to control soil erosion, restore watersheds, and preserve environmentally sensitive lands.

The Department of Fish and Game is also concerned about maintaining instream flows and reservoir pools on the California reaches of Carson Walker Rivers (*Portion of which are protected by the California Wild and Scenic River Act*). In conjunction with American Land Conservancy, a private land trust organization. DFG has been acquiring lands and water rights at Heenan Lake in the upper watershed of the East Fork Carson River. This small reservoir, formerly used to supply irrigation water for lands in Nevada, is now being used by DFG to raise Lahontan cutthroat trout to stock in other locations throughout the Sierra Nevada. Parts of the upper Carson River area is managed by DFG as wild trout waters, where stocking of hatchery fish is not allowed. Recreational trout fishing is a popular activity on both the upper Carson and Walker rivers.

Relationship with Other Regions

An average of about 2,000 acre-feet per year is exported from the Tahoe Basin to the South Fork American River in conjunction with a power development that began in 1876. Another export of about 6,000 acre-feet goes from the Little Truckee River for irrigation use in Sierra Valley (Feather River Basin of Sacramento Region). Much of the supply from the Truckee, Carson, and Walker rivers is reserved for use by Nevada interests under various water rights settlements and agreements. In northern Lassen County, an average of about 3,000 acre-feet is imported from a tributary of the South Fork Pit River (Sacramento River Region) for irrigation in the Madeline Plains area.

Looking to the Future

No major changes in water use are anticipated in the near future in the northern portion of the region. A small amount of agricultural expansion is expected in areas that can support additional groundwater development. Likewise, the modest need for additional municipal and irrigation supplies can be met by some expansion of present surface systems or by increased use of groundwater.

Concern over protecting groundwater resources has led to establishment of formal groundwater management mechanisms in the Honey Lake and Long Valley basins. Similar arrangements are being considered in Surprise Valley and the pending interstate allocation establishes limits on groundwater withdrawals in the Lake Tahoe and Truckee basins. At present, neither the Honey Lake nor Long Valley groundwater management districts are active, but the can be activated when needed.

The Truckee, Carson and Walker rivers are currently controlled by federal water masters according to federal court decrees. Each of these decrees may be revised to some degree within the nest few years through a settlement agreement for the Truckee River and through mediation for the Walker River. Since further water development in these basins may be limited, especially in Nevada, water transfers will increasingly be used to meet changing or higher priority needs within the basins. This has resulted in acquisition of some agricultural land and water rights to meet municipal needs downstream in Reno/Sparks and environmental needs throughout the basins. Northern California counties lack the resources and funding to assist them with regional or local plans.

Water Portfolios for Water Years 1998, 2000, and 2001

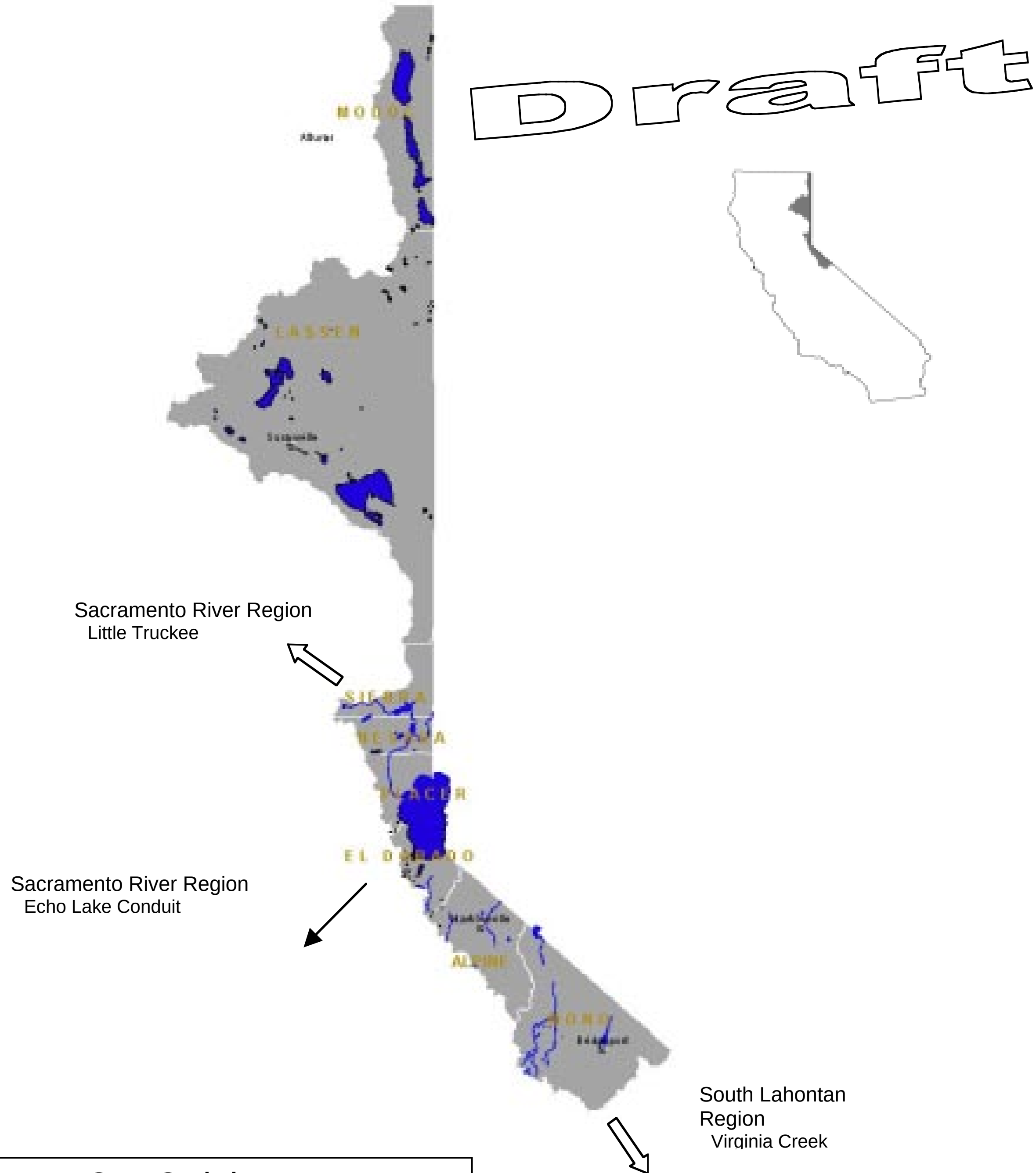
The following tables present actual information about the water supplies and uses for the North Lohanton hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 135 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents less than normal hydrologic conditions with annual precipitation at 80 percent of average for the North Lohanton region, and year 2001 reflected dryer water year conditions with annual precipitation at 50 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 9-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three water portfolio tables included in Table 9-2 and companion Water Portfolio flow diagrams Figures 9-2, 9-3 and 9-4 provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 9-3. Because most of the North Lohanton region is largely undeveloped, dedicated environmental water uses are a larger component of the total developed water uses in this region. Table 9-3 also provides detailed information about the sources of the developed water supplies.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001

Figure 9-1
NORTH LAHONTAN HYDROLOGIC REGION



Some Statistics
▪ Area - 6,122 square miles (3.9% of State)
▪ Average annual precipitation – 23.1 inches
▪ Year 2000 population - 99,035
▪ 2030 population projection – 155,065
▪ Total reservoir storage capacity - 1,181 TAF
▪ 2000 irrigated agriculture - 125,200 acres

Table 9-1
North Lahontan Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	10,655	6,708	3,756
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	0	0	3
Total	**10,655**	**6,708**	**3,759**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	263	330	307
Outflow to Nevada	1,391	754	552
Exports to Other Regions	12	12	9
Statutory Required Outflow to Salt Sink	180	141	113
Additional Outflow to Salt Sink	83	94	91
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	8,569	5,484	3,295
Total	**10,498**	**6,815**	**4,367**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	147	-66	-430
Change in Groundwater Storage **	10	-41	-178
Total	**157**	**-107**	**-608**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	432	528	489

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 9-2
Water Portfolios for Water Years 1998, 2000 and 2001

		North Lahontan 1998 (TAF)				North Lahontan 2000 (TAF)				North Lahontan 2001 (TAF)				
Category	Description	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
Inputs:														
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	10,654.6				6,708.3				3,755.9				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		501.4				469.5				311.8			PSA/DAU
10	Local Imports		0.3				0.3				3.3			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		-				-				-			PSA/DAU
13	State Water Project Deliveries		-				-				-			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		84.6				85.0				84.5			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		5.8				3.6				2.1			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		5.0				5.0				5.0			PSA/DAU
b	Recycled Water - Urban		-				-				-			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		1.5				2.0				1.8			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		19.8				28.9				29.3			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		0.3				0.4				0.3			PSA/DAU
c	Deep Percolation of Applied Water - Urban		12.7				13.3				12.6			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		27.9				36.2				30.8			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		313.5				181.9				126.9			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	853.2				903.5				837.6				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	88.5				161.6				234.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	1,000.0				837.6				407.8				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				294.6				313.6				317.6	REGION
b	Evaporation from Reservoirs				175.5				213.7				267.6	REGION
36	Ag Effective Precipitation on Irrigated Lands		55.8				32.1				8.5			REGION
37	Agricultural Use		375.1	327.4	327.4		462.4	397.3	397.3		428.4	368.3	368.3	PSA/DAU
38	Wetlands Use		18.7	13.4	13.4		25.9	20.7	20.7		20.5	17.1	17.1	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		3.5				4.2				3.7			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		5.1				5.1				5.9			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		4.4				4.8				5.0			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		1.1				1.2				1.3			PSA/DAU
40	Urban Commercial Use		9.0				9.7				9.3			PSA/DAU
41	Urban Industrial Use		12.5				12.5				12.5			PSA/DAU
42	Urban Large Landscape		2.3				2.6				2.6			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		84.6	84.6	84.6		85.0	85.0	85.0		84.5	84.5	84.5	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		404.1	95.6	95.6		233.3	56.2	56.2		152.5	28.7	28.7	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				241.1				301.3				281.1	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				13.2				19.8				16.9	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				8.8				8.7				9.4	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				N/A				N/A				N/A	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				19.5				20.2				12.5	PSA/DAU
50	Urban Waste Water Produced	24.6				26.5				26.5				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				-				-				-	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				2.3				1.7				1.0	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				0.2				0.3				0.2	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				68.3				76.9				74.7	PSA/DAU
b	Return Flows to Salt Sink - Urban				14.9				16.1				16.5	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				0.6				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				180.2				141.2				113.2	REGION
54a	Outflow to Nevada				1,390.6				753.9				551.9	REGION
b	Outflow to Oregon													REGION
c	Outflow to Mexico													REGION
55	Regional Imports	0.3				0.3				3.3				REGION
56	Regional Exports	11.9				11.8				9.2				REGION
59	Groundwater Net Change in Storage	10.0				-41.3				-177.5				REGION
60	Surface Water Net Change in Storage	146.8				-65.9				-429.8				REGION
61	Surface Water Total Available Storage	1,181.2				1,181.2				1,181.2				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 9-3
North Lahontan Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	2.3			2.6			2.6		
Commercial	9.0			9.7			9.3		
Industrial	12.5			12.5			12.5		
Energy Production	0.0			0.0			0.0		
Residential - Interior	7.9			9.0			8.7		
Residential - Exterior	6.2			6.3			7.2		
Evapotranspiration of Applied Water		8.8	8.8		8.7	8.7		9.4	9.4
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		14.9	14.9		16.1	16.1		16.5	16.5
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**37.9**	**23.7**	**23.7**	**40.1**	**24.8**	**24.8**	**40.3**	**25.9**	**25.9**
Agriculture									
On-Farm Applied Water	375.1			462.4			428.4		
Evapotranspiration of Applied Water		241.1	241.1		301.3	301.3		281.1	281.1
Irrecoverable Losses		19.5	19.5		20.2	20.2		12.5	12.5
Outflow		66.8	66.8		75.8	75.8		74.7	74.7
Conveyance Losses - Applied Water	23.5			13.4			6.2		
Conveyance Losses - Evaporation		2.3	2.3		1.7	1.7		1.0	1.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		1.5	1.5		1.1	1.1		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**398.6**	**331.2**	**331.2**	**475.8**	**400.1**	**400.1**	**434.6**	**369.3**	**369.3**
Environmental									
Instream									
Applied Water	84.6			85.0			84.5		
Outflow		84.6	84.6		85.0	85.0		84.5	84.5
Wild & Scenic									
Applied Water	404.1			233.3			152.5		
Outflow		95.6	95.6		56.2	56.2		28.7	28.7
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	18.7			25.9			20.5		
Evapotranspiration of Applied Water		13.2	13.2		19.8	19.8		16.9	16.9
Irrecoverable Losses		0.2	0.2		0.3	0.3		0.2	0.2
Outflow		0.0	0.0		0.6	0.6		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	18.7	13.4	13.4	25.9	20.7	20.7	20.5	17.1	17.1
Total Environmental Use	**507.4**	**193.6**	**193.6**	**344.2**	**161.9**	**161.9**	**257.5**	**130.3**	**130.3**
TOTAL USE AND LOSSES	**943.9**	**548.5**	**548.5**	**860.1**	**586.8**	**586.8**	**732.4**	**525.5**	**525.5**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	501.4	501.4	501.4	469.5	469.5	469.5	311.8	311.8	311.8
Local Imported Deliveries	0.3	0.3	0.3	0.3	0.3	0.3	3.3	3.3	3.3
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SWP Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	41.8	41.8	41.8	112.0	112.0	112.0	189.6	189.6	189.6
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	46.7			49.6			45.3		
Reuse/Recycle									
Reuse Surface Water	348.7			223.7			161.6		
Recycled Water	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
TOTAL SUPPLIES	**943.9**	**548.5**	**548.5**	**860.1**	**586.8**	**586.8**	**716.6**	**509.7**	**509.7**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-15.8*	*-15.8*	*-15.8*

Figure 9-2
North Lahontan Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

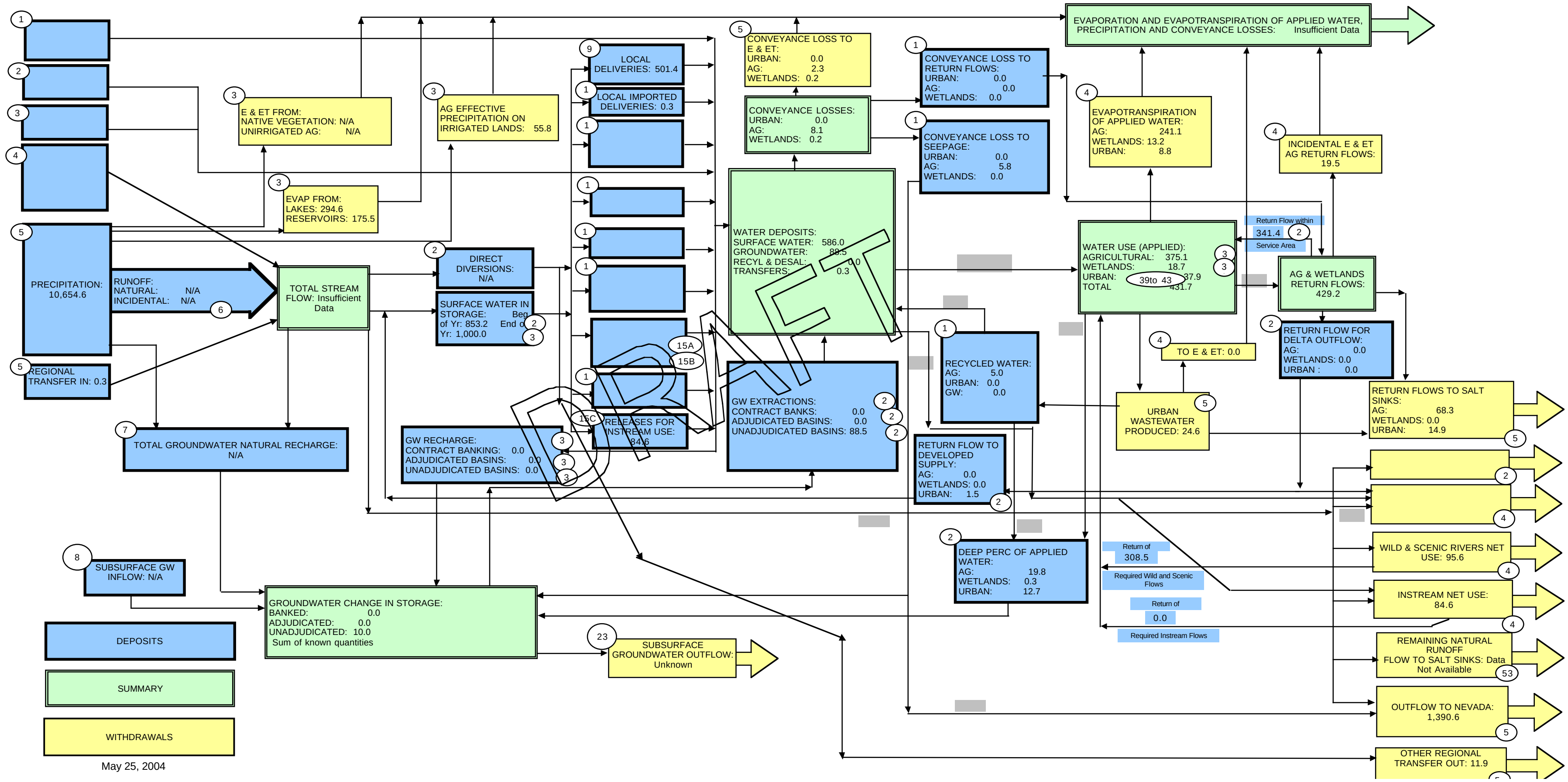


Figure 9-3
North Lahontan Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

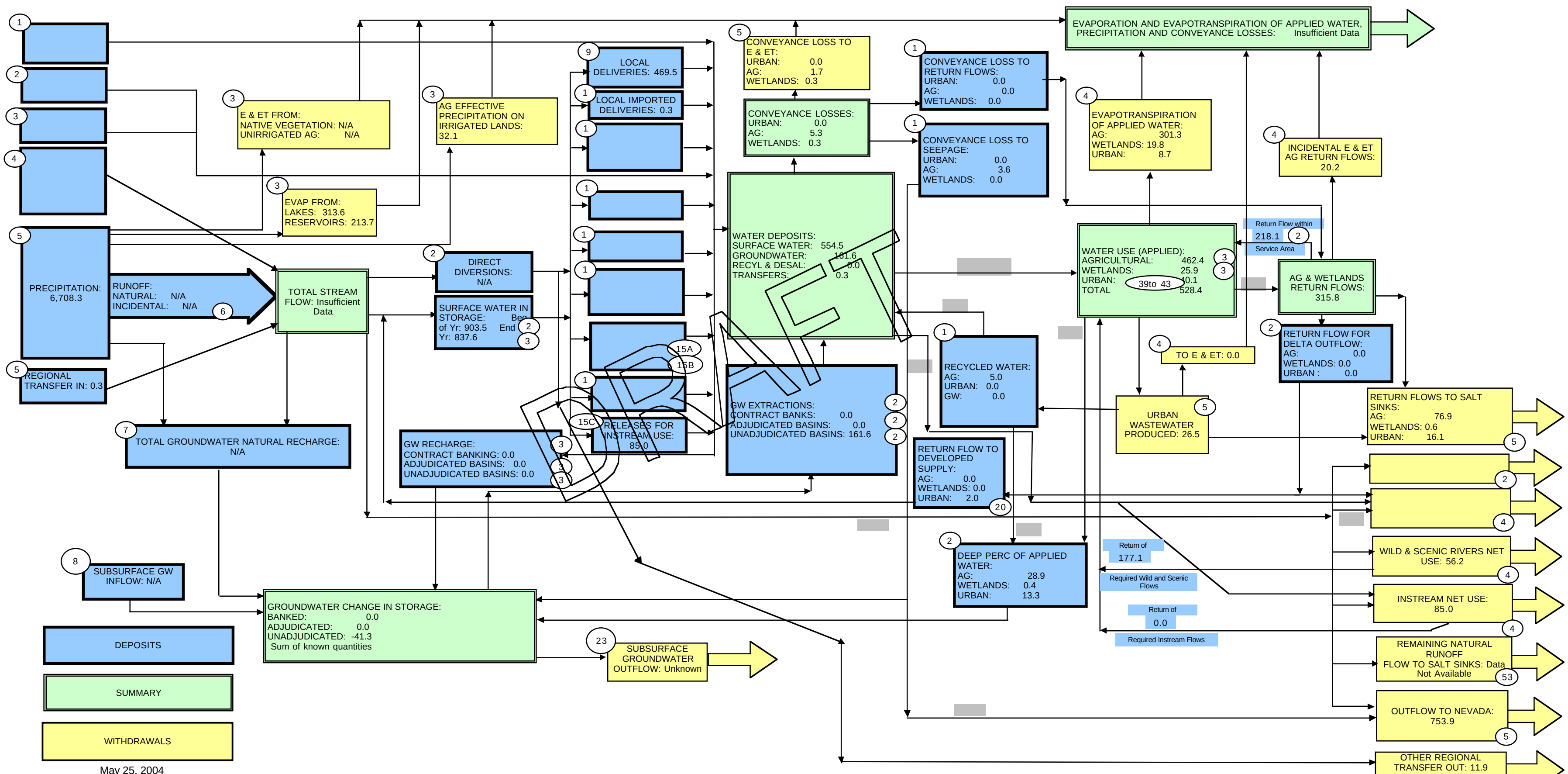
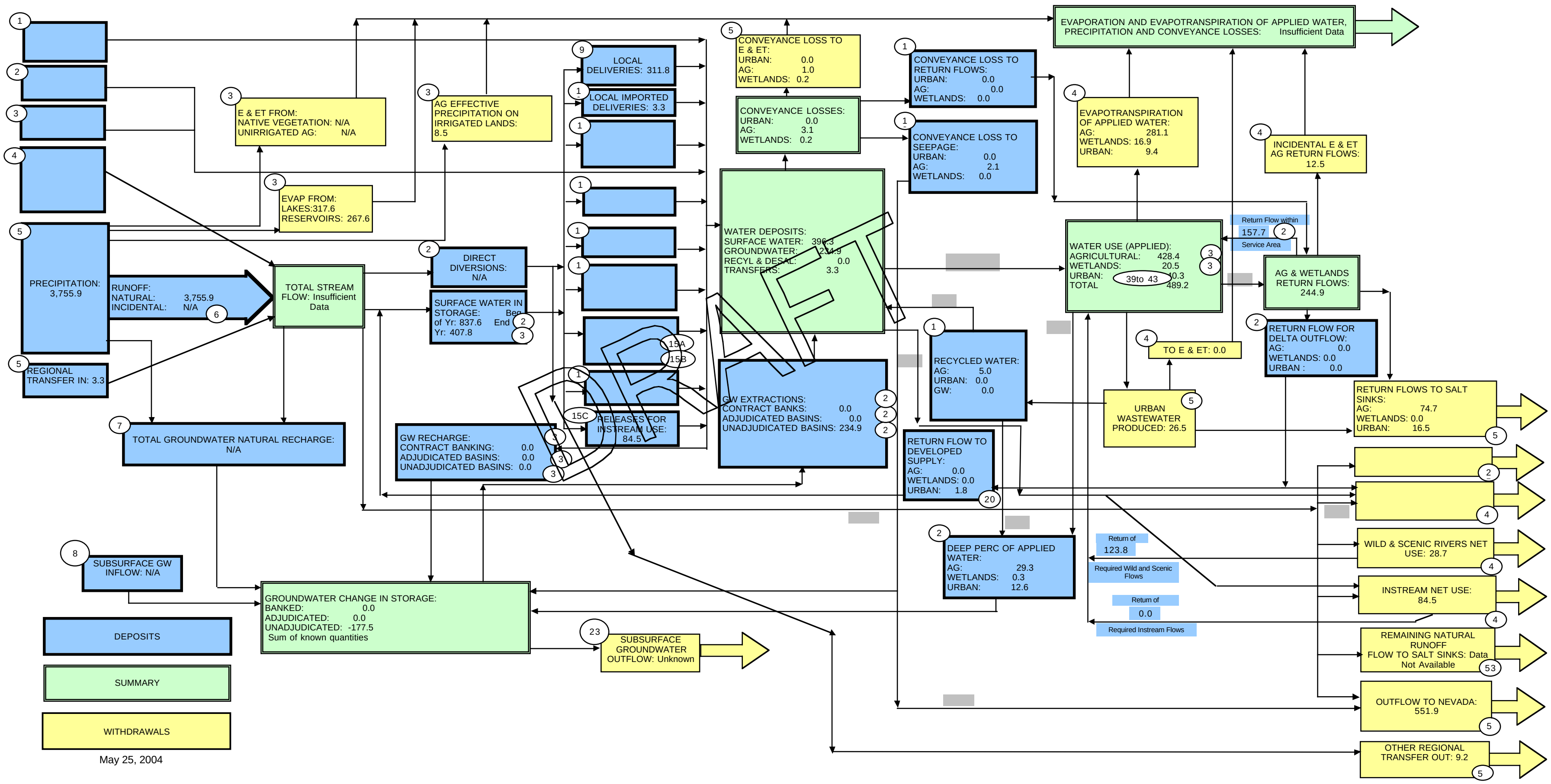


Figure 9-4
North Lahontan Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



May 25, 2004

Chapter 10. South Lahontan Hydrologic Region

Setting

Although the South Lahontan hydrologic region brings to mind images of desert with Joshua trees, sand dunes, and dry lakes, it also contains the glacier-carved Eastern Sierra and the eastern slopes of the San Gabriel and San Bernardino Mountains. The northern half of the region includes Owens Valley, Panamint Valley, Death Valley, and the Amargosa River Valley. Occupying roughly the southern half of the region, the Mojave Desert is characterized by numerous small mountain ranges and many basins of varying sizes. (if we don't have space to identify them by name, we shouldn't allude to them) The region includes all of Inyo County and parts of Mono, San Bernardino, Kern, and Los Angeles Counties (Figure 10-1).

Notable streams and rivers are few in the South Lahontan Region. Owens River is probably the best known. Flowing the length of Owens Valley and fed from the slopes of the Sierras and White Mountains, the once substantial stream cut its way to Owens Lake until most of its flow was intercepted for use in Los Angeles after 1913. Another important river in the region is the Mojave River. Although seldom seen flowing on the earth's surface, its' primarily underground flow supports nearly all the groundwater-supplied agriculture and urban population in the Mojave River Valley. There is one dam on the Mojave River at the base of the San Bernardino Mountains--Mojave River Forks Dam. This USACE flood control facility provides a maximum reservoir storage capacity of 179,400 acre-feet. Does this foregoing dam report belong here? The Amargosa River is the only other significant river in the region. However, the Amargosa does not serve any agriculture and is ephemeral for most of its length.

Climate

The South Lahontan region is a relatively dry one. Annual average precipitation is less than 10 inches, except for the higher mountains. Annual average precipitation in the Sierra ranges from 25 to 50 inches, which can translate to many feet of snow accumulation. Some of the central and eastern portions of the Mojave Desert average only 4 inches annually. Death Valley receives a little less than 2 inches on the average, but just a few tenths of an inch falls in some years. Daytime temperatures in the winter are generally mild, but hot in the summer. (already mentioned)

Death Valley experiences oven-hot environment in the summer, when daytime maxima routinely reach the 110s and low 120s. Most seasons even see a few searing days with temperatures reaching the middle and upper 120s. A reading of 134 degrees was attained on a July day in 1913, the record for the western hemisphere.

Population

Although the region is the largest in the State, its 2000 population was about 709,000, only 2 percent of California's population.Nearly 450,000 of them live in the Antelope, Apple, and Victor Valleys. The Cities of Palmdale and Lancaster were among the fastest-growing ones in the State in the 1990s.

Land Use

Although much of the region's land is under some kind of protected or managed status for recreational, scenic, environmental, and military reasons, the region has significant agricultural acreage and several growing cities. Even though 18,000 acres in the Antelope Valley remain agriculturally productive, it and

Victor Valley have to really be considered an urban realm today. Outside of these valleys and the Cities of Barstow and Ridgecrest, the region is rural with small towns and hamlets of less than 8,000 population standing many miles apart. The region's 65,000 acres of irrigated crops are mainly planted to alfalfa, pasture, and truck and vegetable crops. Most agricultural land is located in the Antelope Valley, along the Mojave River, and in the Mono-Owens area (I thought we were to avoid using PSA identifiers. I believe the "Mono-Owens area" can be used because it is a recognized regional identifier, independent of DWR classification. Alfalfa and pasture grass make up approximately 75 percent of the agricultural acres in the Region, while truck crops (mostly carrots and onions) represent approximately 12 percent.

Water Supplies and Use

The Los Angeles Aqueduct is the region's major water development feature. In 1913, the 223-mile-long, first pipeline of LAA was completed and began conveying water from Owens Valley to the City of Los Angeles Aqueduct was extended 115 miles north into the Mono Basin and diversions began in 1940. A second, 137-mile-long pipeline was completed in 1970.

There are eight reservoirs in the Los Angeles Aqueduct system with a combined storage capacity of about 323 taf. These reservoirs were constructed to store and regulate flows in the aqueduct. The northernmost reservoir is Grant Lake in Mono County. Six of the eight reservoirs are located in the South Lahontan Region. Bouquet and Los Angeles Reservoirs are in the South Coast Region. Water from the aqueduct system passes through 12 power plants on its way to Los Angeles. The annual energy generated is more than 1 billion kWh, enough to supply the needs of 220,000 homes.

Groundwater provides nearly half of the annual water supply in the region. Groundwater is used conjunctively with surface water in the more heavily pumped basins. Seventy-six groundwater basins underlie about 55 percent of the hydrologic region and groundwater storage capacity is estimated for 49 of these basins (DWR 2003). The estimated storage capacity is about 232 million af. Most of the groundwater production is concentrated, along with the population, in basins in the southern and western parts of this hydrologic region. Because much of this hydrologic region is public land with low population density, there has been little groundwater use and little is known about the groundwater in many of the basins.

Five water agencies have contracts with the State Water Project for a total of about 250 taf annually. The East Branch of the SWP California Aqueduct brings imported water into the region. Some of the SWP water is used to recharge groundwater in the Mojave River Valley. Mojave Water Agency (MWA) has taken little of its SWP amount to date, primarily because of financial considerations.

Antelope Valley-East Kern Water Agency, the largest SWP contractor in the region and the third largest in the State, serves five major and 16 small municipal agencies, as well as Edwards AFB, Palmdale Air Force Plant 42, and U.S. Borax and Chemical Facilities. AVEK was formed to bring imported water into the area.

The 2.7 taf capacity Littlerock Reservoir provides water supply to Littlerock Creek Irrigation District and to Palmdale Water District. PWD funded most of a seismic rehabilitation of the 1924-vintage dam in exchange for control of the water supply for 50 years. Water from Littlerock Reservoir is released into a ditch that conveys flows to PWD's Lake Palmdale, a 4.2-taf storage reservoir.

In the San Bernardino Mountains, Lake Arrowhead, owned by the Arrowhead Lake Association, is a 48 taf reservoir providing recreational opportunities and water supply for Arrowhead Woods property owners.

Mojave River Adjudication

The Mojave River Groundwater basin has experienced overdraft since the early 1950s, with the largest increase in overdraft in the 1980s. The Superior Court's final ruling on basin adjudication was issued in January 1996. In its ruling, the Court emphasized that the area has been in overdraft for decades and that MWA must alleviate overdraft through conservation and purchase of supplemental water. MWA was appointed as the basin watermaster. Some non-stipulating parties challenged the Stipulated Judgment and the case was eventually heard by the California Supreme Court in August of 2000. The higher court affirmed the Stipulated Judgment as to the parties, but determined that some of the appellants held overlying water rights that are not subject to the Judgment. Consequently, the Judgment continues to be implemented in the Mojave Basin Area.

The adjudication stipulated that any party pumping more than 10 af/yr became a party to the Judgment and is bound by it. The Judgment stated that each party has a right to its base annual production, which was its highest usage between 1986 and 1990. The Judgment also required Watermaster to initially reduce this amount by at least 5 percent each year for four years as one way to achieve a physical solution to the longstanding overdraft. Any party exceeding its annual allotment must purchase replenishment water from MWA or from other parties to the Judgment. If there is still overdraft after the end of the first five years of the Judgment, water use in overdrafted subareas will be further reduced. The Judgment recognized five basin subareas and required that if an upstream subarea does not meet its obligation to a downstream subarea, the upstream area must pay for supplemental water.

The Town of Mammoth Lakes serves surface and groundwater to a permanent population of only about 5,000, an average daily population of about 13,000, and a peak weekend and holiday period population up to 30,000 per day. Most environmental water demands involve the restoration of the water surface elevation of Mono Lake and releases into the Owens River that were intercepted for use in Los Angeles after 1913. The other important river in the region is the Mojave River. Although seldom seen flowing on the earth’s surface, its’ primarily underground flow supports nearly all the groundwater-supplied agriculture and urban population in the Mojave River Valley.

Alfalfa produced in the region uses groundwater as the primary irrigation source. In the Mono-Owens PA, water supplies from the Los Angeles Aqueduct are used in the flood irrigation of improved native pasture grass fields. Ground and surface water is not the only source of water available to grow alfalfa. In the Antelope Valley region of Los Angeles County, 680 acres of alfalfa have been irrigated for the last fourteen years with municipal effluent. The treated water comes from the Lancaster Water Reclamation Plant owned and operated by the County Sanitation District No. 14 of Los Angeles County.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, exports from the region far exceed the consumptive uses within the region.

State of the Region

Challenges

Many parts of the region commonly experience shortfalls in water supplies. For example, a study by the Antelope Valley Water Group concluded that the valley's existing and future water supply reliability from groundwater, the SWP, Littlerock Reservoir, and recycling is low and that full 1998 water demands would be met only half the time without overdrafting groundwater resources. Meeting water demands for projected growth and development is a concern for many water agencies. Overdrafting groundwater resources can also dry up watering holes needed by wildlife.

Surface water quality is excellent in the region, greatly influenced by snowmelt from the eastern Sierra Nevadas. At lower elevations, though, water quality can be degraded, both naturally (from geothermal activity) and anthropogenically (e.g. recreation, grazing). Nutrients entering Crowley Reservoir have contributed to low dissolved oxygen levels in reservoir releases, resulting in fish kills downstream. Water quality and quantity are inherently related in the Owens River watershed due to the large exports of surface and groundwater to the City of Los Angeles. Arsenic, a known human carcinogen, is a health concern in the basin, and therefore, in Los Angeles as well, especially with the impending lower drinking water standard. While the vast majority of public water supply wells meet drinking water standards, when these standards are exceeded, it is most often for TDS, fluoride, or boron. Several domestic water supply wells in the Barstow area have been closed due to historical contamination from industrial and domestic wastewater. Three military installations in the southwestern part of the region are on the federal Superfund National Priorities List because of volatile organic compounds and other hazardous contaminants, and the infamous PG&E chromium groundwater contamination site in Hinkley is also in this region. In its triennial review, the Lahontan Regional Board identified the need for site-specific ammonia objectives for Paiute Ponds and Amargosa Creek in Los Angeles County.

Accomplishments

The Indian Wells Valley Water District has been involved in a cooperative study and project to alleviate declining water levels and to manage water quality problems. Imported water would be used for recharge, if available. Studies are being conducted to determine where recharge would be most feasible. Additional studies will attempt to determine the age and source of deep groundwater, that has higher levels of minerals.

The region has already developed solutions to two major issues within the past 10 years. Over use of the Mojave River Valley groundwater and water diversions from the Owens River/Mono Basin by the City of Los Angeles both negatively affected the region for decades. Overdraft of the Mojave River groundwater basin since the early 1950s lead to adjudication in 1996 and the appointment of the Mojave Water Agency as the basin watermaster. The Los Angeles Department of Water and Power (LADWP) is presently involved with many restoration projects for the Owens River and Mono Basin. In 1993, LADWP began final flow releases to restore Mono Lake to a water surface elevation of 6,392 feet. By 2003, Mono Lake elevation had reached 6,382, a level where LADWP can export 16,000 acre-feet per year. LADWP has developed plans to help ranchers manage grazing practices in the Crowley Lake tributary area. The Owens Gorge Rewatering Project, and the Lower Owens River Project are two premier restoration programs being implemented by LADWP to restore the river after 50 years of dewatering. Several other restoration projects are under way.

In 1994, Mojave Water District completed its Morongo Basin pipeline, a 70-mile pipeline with a capacity of 100 cfs, from the SWP's East Branch to the Mojave River (7 miles) and then 22 cfs to Morongo Basin and Johnson Valley. This pipeline allows MWA to bring SWP water into part of its large (almost 5,000-square-mile) service area. MWA has been delivering about 3.5 taf per year to the Hi-Desert Water District since completion of the Morongo Basin Pipeline. In 1997, MWA began construction of its 71-mile Mojave River Pipeline (94 cfs capacity) to bring imported water to the Barstow area and neighboring communities downstream to the Newberry Springs area. The pipeline has been constructed a distance of approximately 61 miles to a recharge facility along the river near the community of Daggett. Recharge facilities have also been constructed along the river near the communities of Hodge and Lenwood. The final reaches of the pipeline are expected to be completed by the end of 2004 or early 2005, terminating with a recharge facility in the Newberry Springs area.

Mojave Water District has entered into a multiyear banking and exchange agreement with Solono County Water Agency. During any wet year, SCWA can bank up to 10,000 acre-feet of its annual SWP water in MWA's groundwater basin, not to exceed a total balance of 20,000 acre-feet. During drought years, SCWA can take part of MWA's SWP water in exchange. MWA has developed ability to store more imported supplies in the Mojave River Basin at MWA's Rock Springs groundwater recharge facility and is considering more recharge facilities in other areas. Several other districts are considering groundwater recharge projects. Loan and grant programs, especially for drought relief, will continue to be needed in the region. Also, monitoring and cleanup of chromium in groundwater and cleanup of sites contaminated by mining wastes continue to be needed in the region.

Relationship with Other Regions

While most of Mojave Water District's service area is within the South Lahontan Region, the service area extends into the Colorado River Hydrologic Region (Lucerne and Johnson Valleys and the Morongo Basin), which includes the Town of Yucca Valley. Part of MWA's SWP water (up to 7.2 taf) is allocated to that area.

Some imported State Water Project water is used to recharge groundwater in the Mojave River Valley basins. Surface water and groundwater are exported from the South Lahontan Hydrologic Region to the South Coast Hydrologic Region by the Los Angeles Department of Water and Power.

Looking to the Future

Many water districts have taken a proactive approach to the water reliability problems and have commenced studies and projects that could provide partial or complete solutions. These include water conservation programs, water recycling, and groundwater recovery, and water marketing and other water supply augmentation responses.

Regional Planning

Mojave Water District has initiated a demonstration project in the Oro Grande Wash south of the City of Victorville and east of Hesperia to determine the effectiveness of artificial recharge using State Water Project water. The project site is several miles from the main stem of the Mojave River and is intended to supply imported water for use by local water purveyors in an area of the Agency that is developing rapidly. This project is the first of several off-river recharge projects, that the Agency considers the next major phase in water supply infrastructure development.

MWA is currently updating its Regional Water Management Plan, which will allow it to identify and prioritize future water supply projects. The updating process began in 2002 and is expected to be concluded by 2005.

With a growing population and heavy demands on the limited supplies of fresh water for its service area, Victor Valley Wastewater Reclamation Authority (VVWRA) is planning an ambitious program in which it intends to add facilities that would recycle millions of gallons of wastewater daily. In 1997, the VVWRA completed a feasibility study that projected population growth and wastewater treatment requirements, identified potential reclamation strategies and costs through 2020. The strategies included potential uses of fully-treated effluent for beneficial uses such as landscape irrigation, industrial process water, and other purposes. In 2000, VVWRA adopted amendments to the plan, which projected future wastewater flows in the service area with greater accuracy. In 2002, another amendment was adopted that recommended the development of four sub-regional reclamation facilities by the year 2010. The current wastewater flows of 9 MGD from more than 100,000 residents and numerous businesses are expected to increase to more than 18.7 MGD by the year 2020. Also in 2002, VVWRA completed expansion of its treatment plant to accommodate flows of up to 11 million gallons per day. Financing for the project came from a zero-interest State Revolving Loan approved by the State Water Resources Control Board.

The Antelope Valley Water Group was formed in 1991 to provide coordination among valley water agencies and other interested entities. AVWG members include the Cities of Palmdale and Lancaster, Edwards AFB, AVEK, Antelope Valley United Water Purveyors Association, Los Angeles County Waterworks Districts, PWD, Rosamond Community Services District, and Los Angeles County. AVWG completed an Antelope Valley water resources study in 1995 to address regional water management issues.

The study evaluated the valley's existing and future water supplies from groundwater, the SWP, Littlerock Reservoir, and recycling, and compared these supplies with projected water demands. The study concluded that water supply reliability is low in the study area--full 1998 demands would be met only half the time without overdrafting groundwater resources. The study recommended water conservation, recycling, and conjunctive use measures to reduce expected shortages. The study identified three sites (two on Amargosa Creek and one on Littlerock Creek) with high potential for groundwater recharge through spreading and identified SWP water, recycled water, and local runoff as potential recharge sources. The study also identified several potential groundwater injection sites within existing Los Angeles County Waterworks and PWD municipal wellfields. Treated SWP water was identified as a potential recharge source.

In 2001, Palmdale Water District adopted a water facilities master plan for its service area, which updated the 1996 and 1989 master plans. PWD relies on three water sources: Littlerock Reservoir, local groundwater, and SWP water. The master plan indicates PWD’s desire to maintain a capacity to obtain 40 percent of its supply from groundwater. However, because declining groundwater levels have been a local concern in the Palmdale area, it is not clear that extractions are presently within the basin’s perennial yield. Moreover, the plan indicates that existing supplies are insufficient to meet drought demands without demand reductions and that average year shortages are projected to occur by 2010.

To help meet future demands, the plan calls for the construction of up to six new wells and the equipping of four existing cased wells so they could be used to help meet potable water demands. The Draft Environmental Impact Report for the plan identified a further decline (or a continuing decline) in groundwater levels as an unavoidable impact of constructing new wells and pumping additional groundwater to maintain that source for 40 percent of PWD's supply. Mitigation measures recommended include water conservation and drought year water demand reduction, conjunctive use programs, acquisition of additional SWP Table “A” amount water (4.0 taf was added in 1999), participation in water transfers, and development of uses for recycled water.

In preparation for a future conjunctive use project, the Quartz Hill Water District drilled six wells in 2002. Only four of the wells were equipped to pump because the yield on the other two was too low. The wells are to be used for water supply. In addition, Quartz Hill plans to add injection equipment to some wells so that they can be utilized to recharge the ground water basin if surplus water supplies become available.

In 2001, the VVWRA Board of Commissioners approved a draft policy to sell recycled water at the current river discharge to stipulated parties in the Mojave Adjudication and held a public hearing on the policy. Under the policy, recycled water would be sold and credited to individual parties for use in meeting makeup water and/or replacement water obligations required by the adjudication. However, the Board tabled consideration of the proposed policy until current challenges to the Mojave Adjudication are settled by the Superior Court.

Water Portfolios for Water Years 1998 and 2000

The following tables present actual information about the water supplies and uses for the South Lahontan hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 180 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents less than normal hydrologic conditions with annual precipitation at 55 percent of average for the South Lahontan region, and year 2001 reflected normal water year conditions with annual precipitation at 100 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 10-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables included in Table 10-2 and companion Water Portfolio flow diagrams (Figures 10-2, 10-3 and 10-4) provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 10-3. Table 10-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems and include a large percentage of water imports from other regions.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001

Figure 10-1
South Lahontan Hydrologic Region

Some Statistics

- Area - 26,732 square miles (16.9% of State)
- Average annual precipitation – 7.8 inches
- Year 2000 population - 709,215
- 2030 projected population –
- Total reservoir storage capacity - 459 TAF
- 2000 irrigated agriculture - 64,720 acres

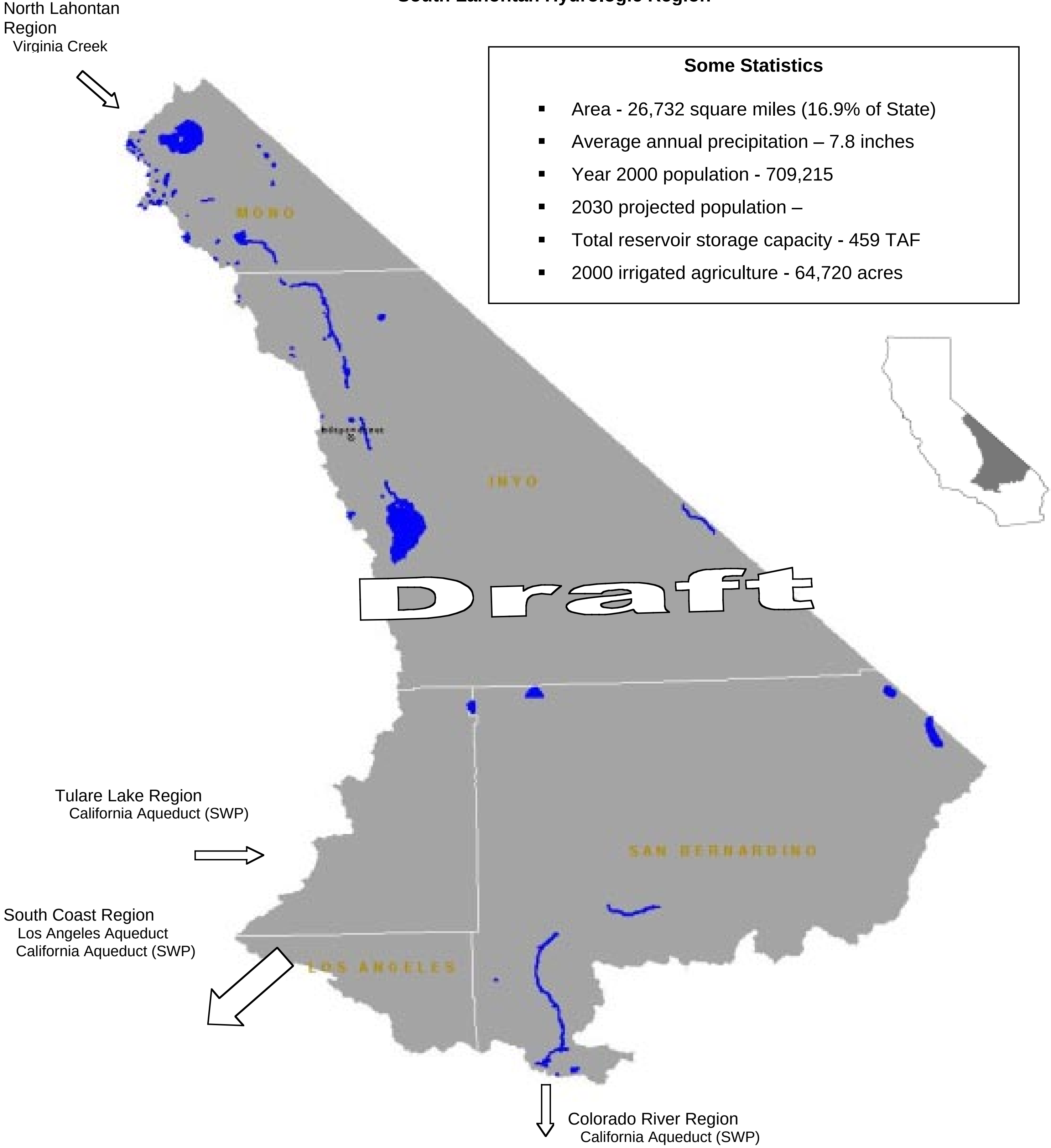


Table 10-1
South Lahontan Hydrologic Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	20,409	7,476	9,741
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	543	836	534
Total	**20,952**	**8,312**	**10,275**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	291	335	329
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	871	1,001	707
Statutory Required Outflow to Salt Sink	80	67	58
Additional Outflow to Salt Sink	118	138	126
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	19,780	7,061	9,360
Total	**21,140**	**8,602**	**10,580**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	72	-8	-1
Change in Groundwater Storage **	-260	-282	-304
Total	**-188**	**-290**	**-305**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	519	598	571

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 10-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	South Lahontan 1998 (TAF)				South Lahontan 2000 (TAF)				South Lahontan 2001 (TAF)				Data
Inputs:		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Detail
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	20,409.3				7,476.1				9,740.9				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		56.6				58.1				46.8			PSA/DAU
10	Local Imports		-				-				-			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		-				-				-			PSA/DAU
13	State Water Project Deliveries		73.2				108.0				79.1			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		98.4				88.8				78.4			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		28.0				29.0				29.4			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		63.5				81.5				79.0			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		42.8				44.2				38.4			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		-				-				-			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		-				-				-			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		18.6				21.4				20.6			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	329.4				326.2				317.8				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	61.8				61.8				61.8				PSA/DAU
29	Groundwater Extractions - Unadjudicated	247.5				277.6				293.7				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	401.5				317.8				316.5				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				162.4				163.7				163.4	REGION
b	Evaporation from Reservoirs				45.1				45.1				42.1	REGION
36	Ag Effective Precipitation on Irrigated Lands		-				-				-			REGION
37	Agricultural Use		326.8	284.0	284.4		360.9	316.7	320.4		343.9	305.5	305.5	PSA/DAU
38	Wetlands Use		-	-	-		-	-	-		-	-	-	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		66.9				98.1				94.9			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		59.2				67.8				73.8			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		11.0				23.7				12.7			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		7.2				11.6				7.2			PSA/DAU
40	Urban Commercial Use		26.0				16.8				18.1			PSA/DAU
41	Urban Industrial Use		8.2				4.8				5.5			PSA/DAU
42	Urban Large Landscape		7.7				8.0				9.0			PSA/DAU
43	Urban Energy Production		6.3				6.3				6.3			PSA/DAU
44	Instream Flow		98.4	79.8	79.8		88.8	67.4	67.4		78.4	57.8	57.8	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		-	-	-		-	-	-		-	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				216.8				247.6				239.1	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				-				-				-	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				74.1				87.4				90.1	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				6.7				7.3				6.7	PSA/DAU
50	Urban Waste Water Produced	28.5				35.3				33.3				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				9.0				10.5				10.1	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				-				-				-	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				60.9				65.5				59.7	PSA/DAU
b	Return Flows to Salt Sink - Urban				56.8				72.0				66.7	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				79.8				67.4				57.8	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	543.2				836.1				533.9				REGION
56	Regional Exports	871.2				1,000.5				706.6				REGION
59	Groundwater Net Change in Storage	-260.1				-282.3				-303.5				REGION
60	Surface Water Net Change in Storage	72.1				-8.4				-1.3				REGION
61	Surface Water Total Available Storage	458.9				458.9				458.9				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

Table 10-3
South Lahontan Hydrologic Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	7.7			8.0			9.0		
Commercial	26.0			16.8			18.1		
Industrial	8.2			4.8			5.5		
Energy Production	6.3			6.3			6.3		
Residential - Interior	77.9			121.8			107.5		
Residential - Exterior	66.4			79.4			81.1		
Evapotranspiration of Applied Water		74.1	74.1		87.4	87.4		90.1	90.1
Irrecoverable Losses		29.0	29.0		38.6	38.6		34.8	34.8
Outflow		31.3	31.3		37.5	37.5		35.8	35.8
Conveyance Losses - Applied Water	4.9			5.1			4.8		
Conveyance Losses - Evaporation		4.9	4.9		5.1	5.1		4.8	4.8
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	6.4			12.9			13.6		
GW Recharge Evap + Evapotranspiration		0.6	0.6		1.3	1.3		1.4	1.4
Total Urban Use	**203.8**	**139.9**	**139.9**	**255.1**	**169.9**	**169.9**	**245.9**	**166.9**	**166.9**
Agriculture									
On-Farm Applied Water	326.8			360.9			343.9		
Evapotranspiration of Applied Water		216.8	216.8		247.6	247.6		239.1	239.1
Irrecoverable Losses		6.7	6.7		7.3	7.3		6.7	6.7
Outflow		60.9	60.9		65.5	65.5		59.7	59.7
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**326.8**	**284.4**	**284.4**	**360.9**	**320.4**	**320.4**	**343.9**	**305.5**	**305.5**
Environmental									
Instream									
Applied Water	98.4			88.8			78.4		
Outflow		79.8	79.8		67.4	67.4		57.8	57.8
Wild & Scenic									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	0.0			0.0			0.0		
Evapotranspiration of Applied Water		0.0	0.0		0.0	0.0		0.0	0.0
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Environmental Use	**98.4**	**79.8**	**79.8**	**88.8**	**67.4**	**67.4**	**78.4**	**57.8**	**57.8**
TOTAL USE AND LOSSES	**629.0**	**504.1**	**504.1**	**704.8**	**557.7**	**557.7**	**668.2**	**530.2**	**530.2**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	56.6	56.6	56.6	58.1	58.1	58.1	46.8	46.8	46.8
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SWP Deliveries	73.2	73.2	73.2	108.0	108.0	108.0	79.1	79.1	79.1
Required Environmental Instream Flow	79.8	79.8	79.8	67.4	67.4	67.4	57.8	57.8	57.8
Groundwater									
Net Withdrawal	266.5	266.5	266.5	295.2	295.2	295.2	317.1	317.1	317.1
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	42.8			44.2			38.4		
Reuse/Recycle									
Reuse Surface Water	82.1			102.9			99.6		
Recycled Water	28.0	28.0	28.0	29.0	29.0	29.0	29.4	29.4	29.4
TOTAL SUPPLIES	**629.0**	**504.1**	**504.1**	**704.8**	**557.7**	**557.7**	**668.2**	**530.2**	**530.2**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 10-2
South Lahontan Hydrologic Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

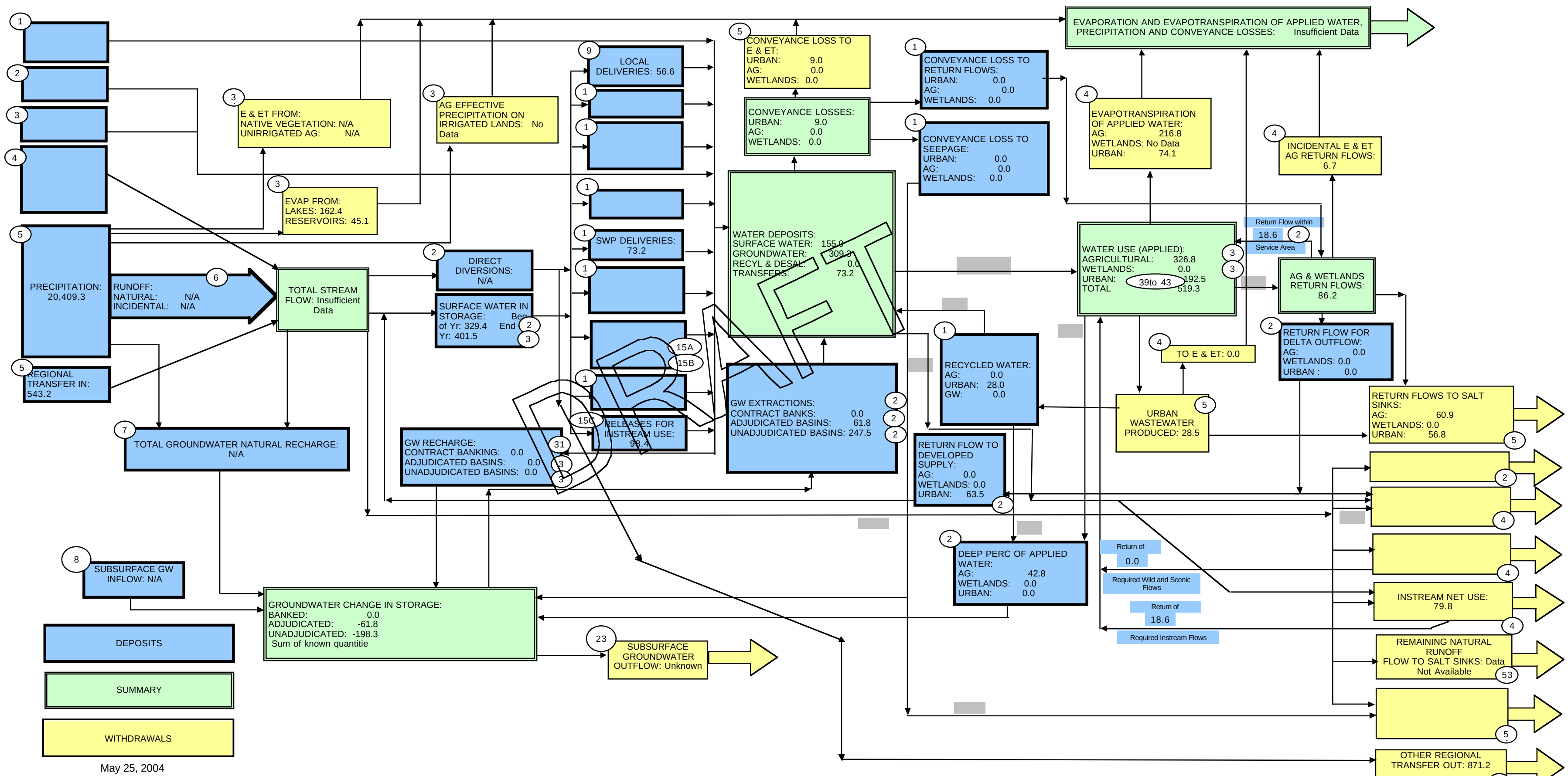


Figure 10-3
South Lahontan Hydrologic Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

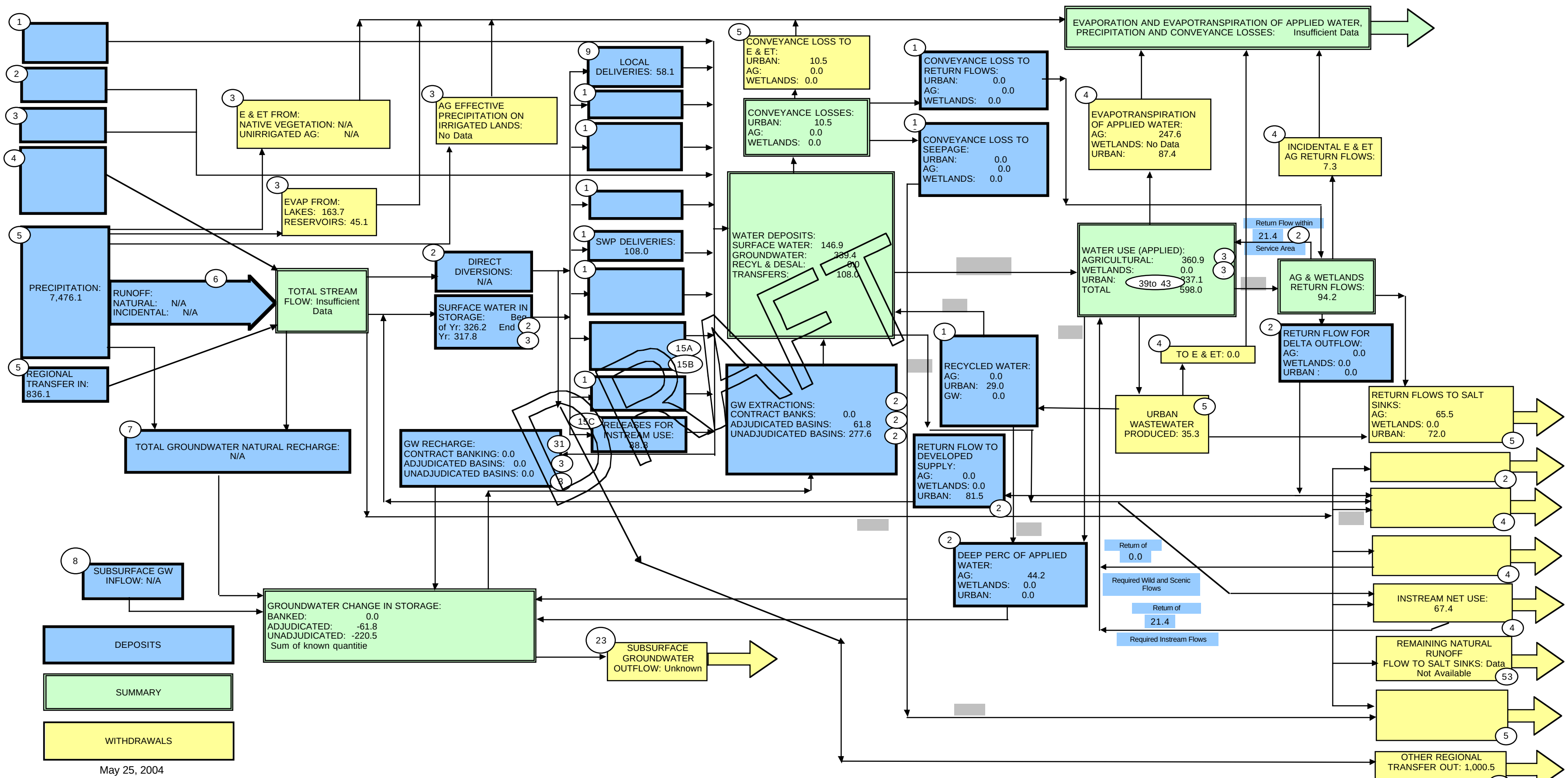
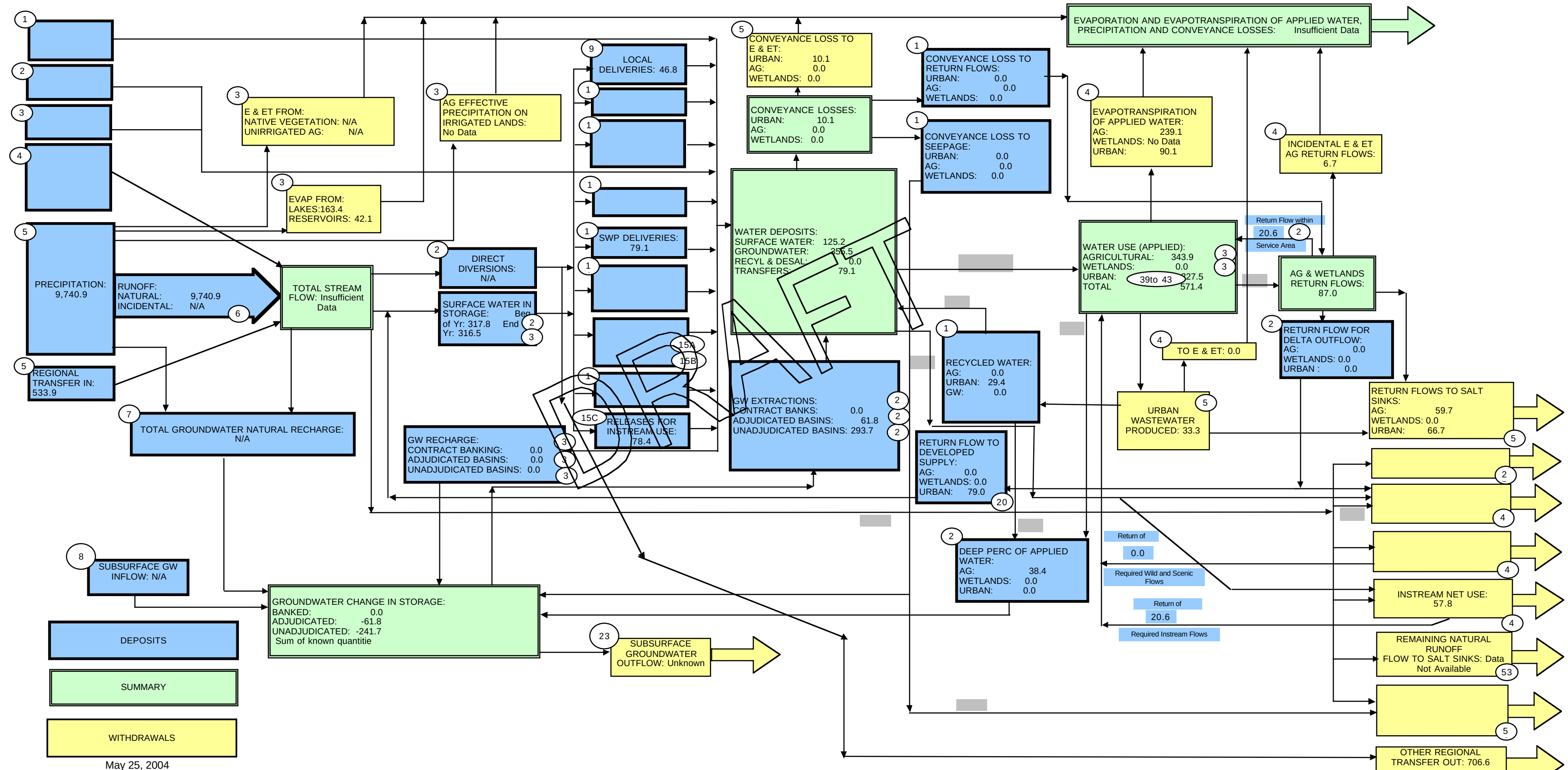


Figure 10-4
South Lahontan Hydrologic Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 11. Colorado River Hydrologic Region

Setting

The Colorado River Hydrologic Region is located in the southeast portion of California (Figure 11-1 is a map and table of statistics that describe the region). The region includes all of Imperial County, approximately the eastern one-fourth of San Diego County, the eastern two-thirds of Riverside County, and about the southeast one-third of San Bernardino County. The Colorado River Region contains 12 percent of the State's area. It has many bowl-shaped valleys, broad alluvial fans, sandy washes, and hills and mountains. The Colorado River forms most of the region's eastern boundary and Mexico forms its southern boundary.

Owing to hydrologically-determined boundaries, the Colorado River region includes a portion of the Mojave Desert, primarily that part of the region within San Bernardino County and eastern Riverside County. The area to the east and south of the Mojave Desert area is a portion of the Sonoran Desert Elevations in the region mostly range from 1,000 to 3,000 feet in the Mojave Desert to less than 1,000 feet in the Coachella, Imperial, and Colorado River Valleys. Mountain peaks attain elevations from 6,000 to 7,000 feet. Many of the valleys contain playas, some quite large, including Bristol Dry Lake, which covers more than 50 square miles.

Climate

Nearly all of the Colorado River Region has a subtropical desert climate with hot summers and mostly mild winters, and the average annual rainfall is quite small. Average annual precipitation ranges from three to six inches, most of which occurs in the winter. However, summer storms do occur and can be significant in some years. Clear and sunny conditions typically prevail. The region receives from 85 to 90 percent of possible sunshine each year, the highest value in the United States. Winter maximum temperatures are mild, but summer temperatures are very hot.

Population

In 2000, the estimated population for the Region was about 606,000, which represented an increase of 31 percent from the 1990 population. More than half of the region's population resides in the Coachella Valley with most of the remaining located in Imperial Valley and in the corridor between the cities of Yucca Valley and Twenty-nine Palms along Highway 62.

Land Use

The region is a land of unequalled agricultural bounty with a growing urban sector, and large expanses of open, wild terrain. The U. S. Bureau of Land Management administers much of the Region, but many other entities have responsibilities.

Famous parks in the region include Joshua Tree National Park, the Mojave National Scenic Preserve, Anza-Borrego Desert State Park, and the Salton Sea and the Picacho State Recreation Areas. There are also several national recreation and wilderness areas, various preserves and wildlife refuges, and Indian reservations in the Region coming under some kind of preservation or managed status.

Despite the arid conditions, significant areas of agricultural and urban land uses exist in the region. The most prominent of these uses belongs to agriculture. More than $1.5 billion of agricultural commodities is produced in the region annually. Over 600,000 acres of land are farmed each year. The largest area of farming occurs in the Imperial Valley where over 450,000 acres of land are farmed annually. More than 93,000 acres are farmed in the Palo Verde Valley, followed by 60,000 in the Coachella Valley Smaller, but equally important agricultural operations are occurring in the Bard and Mohave Valleys.

A wide variety of crops are planted and harvested in the region, some of which are seasonally controlled. In terms of acres, alfalfa is the leading crop produced in the region. Almost 250,000 acres were cultivated in 2000, with 180,000 acres occurring in the Imperial Valley. Although constrained by climate, winter and spring vegetables, which includes lettuce, broccoli, onions, and melons, rank second in overall acres. Of the 150,000 acres harvested, almost 100,000 acres of the vegetables harvested in 2000 came from the Imperial Valley.

The Coachella and Bard Valleys are noteworthy for citrus and subtropical fruit production, especially dates. Also, the table grape industry in the Coachella Valley is well established.

The cattle industry in Imperial Valley is extremely important. It ranks as the highest-valued commodity produced in the Valley.

Other important crops grown in the region include wheat, sugar beets, and Sudan grass. Although less than now than its peak in the early 1980s, cotton is still grown in the region, mostly in the Palo Verde Valley.

Salton Sea

The present day Salton Sea was formed in 1905, when Colorado River water flowed through a break in a canal that had been constructed along the U.S./Mexican border to divert the river's flow to agricultural lands in the Imperial Valley. Until that break was repaired in 1907, the full flow of the river was diverted into the Salton Sink, a structural trough whose lowest point is about 278 feet below sea level. Over time, the Colorado River's course has altered several times. At times, the river discharged to the Gulf of California as it does today. At other times it flowed into the Salton Sink. Lake Cahuilla, the most recent of several prehistoric lakes to have occupied the Salton Sink, dried up some 300 years ago. In the past 2000 years, archaeological records indicate that the Colorado River actually headed northwest into the Salton Sink or Trough more often than it headed south into the Gulf of California. Over the long term, the Sea's elevation has gradually increased, going from a low on the order of 250 feet below sea level in the 1920s to its present level of about 226 feet below sea level.

It should be noted that multiple-cropping is prevalent in the Imperial, Palo Verde, Coachella, and Bard Valleys. In 2000, it was estimated that over 100,000 acres were double-cropped in the region.

Contrasting urban land uses co-exist in the region. In the Imperial and Palo Verde Valleys and the southern one-half of the Coachella Valley, small to moderately sized cities and communities exist which provide support for the surrounding agricultural activities. There are also numerous single-family residential dwellings scattered throughout the region. Many of the business and industrial sectors in the Cities of Blythe, Brawley and Indio provide this kind of support.

In the northern Coachella Valley, the urban area continues to expand between the Cities of Palm Springs and Indio. Other cities in this area include Palm Desert, Rancho Mirage, and La Quinta. This corridor is characterized by the presence of numerous extensively landscaped residential developments, expansion of local business and consumer service centers, construction of luxury hotels and resort properties, and the operation of over 100 private and public golf courses. The expansion has been underway for several decades and does not appear to be subsiding. The expansion supports the region's recreation and tourism industry and the growing number of wealthy retirees and part-time residents.

Although smaller in scale, the urban area in the corridor between the Cities of El Centro and Imperial and within the City of Calexico has also been expanding. Business and consumer services there support consumers in the Imperial Valley and from the neighboring Mexicali Valley.

Water Supply and Use

About 90 percent of the region's water supply is from surface deliveries from the Colorado River (through the All-American and Coachella Canals, local diversions, and the Colorado River Aqueduct by means of an exchange for State Water Project (SWP) water). The Colorado River is an interstate (and international) river whose use is apportioned among the seven Colorado River Basin states by a complex body of statutes, decrees, and court decisions known collectively as the "Law of the River" (Table 11-1). Local surface water, groundwater, and the SWP (Table 11-3) provide the remainder of water to the region. Many of the alluvial valleys in the region are underlain by groundwater aquifers that are the sole source of water for local communities. Many of the alluvial valleys have poor quality water that is not suitable for potable use.

Table 11-1
Key Elements of the Law of the River

Document	Date	Main Purpose
Colorado River Compact	1922	The Upper Colorado River Basin and the Lower Colorado River Basin are each provided a basic apportionment of 7.5 maf annually of consumptive use. The Lower Basin is given the right to increase its consumptive use an additional 1 maf annually.
Boulder Canyon Project Act	1928	Authorized USBR to construct Boulder (Hoover) Dam and the All-American Canal (including the Coachella Canal), and gave congressional consent to the Colorado River Compact. Also provided that all users of Colorado River water must enter into a contract with USBR for use of the water.
California Limitation Act	1929	Limited California's share of the 7.5 maf annually apportioned to the Lower Basin to 4.4 maf annually, plus no more than half of any surplus waters.
Seven Party Agreement	1931	An agreement among seven California water agencies/districts to recommend to the Secretary of Interior how to divide use of California's apportionment among the California water users.
U.S. - Mexican Treaty	1944	Apportions Mexico a supply of 1.5 maf annually of Colorado River water except under surplus or extraordinary drought conditions.
U.S. Supreme Court Decree in *Arizona v. California, et al.*	1964	Apportions water from the mainstream of the Colorado River among the Lower Division states. When the Secretary determines that 7.5 maf of mainstream water is available, it is apportioned 2.8 maf to Arizona, 4.4 maf to California, and 0.3 maf to Nevada. Also quantifies tribal water rights for specified tribes, including 131,400 af for diversion in California.
Colorado River Basin Project Act	1968	Authorized construction of the Central Arizona Project and requires Secretary of the Interior to prepare long-range operating criteria for major Colorado River reservoirs.
U.S. Supreme Court Decree in *Arizona v. California, et al.*	1979	Quantifies Colorado River mainstream present perfected rights in the Lower Basin states.

Within California, the Seven Party Agreement (Table 11-2) established local agencies' apportionments of Colorado River water. The Secretary of the Interior apportions water to California water users according to the Seven Party Agreement. Water use that occurs within a state is charged to that state's allocation. Thus, federal water uses or uses associated with federal reserved rights (e.g., tribal water rights) must also be accommodated within California's basic apportionment of 4.4 maf/yr plus one-half of any available surplus water.

Table 11-2
Annual Apportionment of Use of Colorado River Water
(amounts represent consumptive use)

Interstate/International		
Upper Basin States (Wyoming, Utah, Colorado, New Mexico, small portion of Arizona)		7.5 maf
Lower Basin States (Arizona, Nevada, California)		7.5 maf
	Arizona	2.8 maf
	Nevada	0.3 maf
	California	4.4 maf
Republic of Mexico [a]		1.5 maf
a. Plus 200 taf of surplus water, when available. Water delivered to Mexico must meet specified salinity requirements. During an extraordinary drought, Mexico shares portionally with uses in the United States.		
Intrastate (Seven Party Agreement) [b]		
Priority 1	Palo Verde Irrigation District (based on area of 104,500 acres).	
Priority 2	Lands in California within USBR's Yuma Project (not to exceed 25,000 acres).	
Priority 3	Imperial Irrigation District and lands served from the All American Canal in Imperial and Coachella Valleys, and Palo Verde Irrigation District for use on 16,000 acres in the Lower Palo Verde Mesa.	
Priorities 1 through 3 collectively are not to exceed 3.85 maf/yr. There is no specified division of that amount among the three priorities. (Although this division was further defined in the Quantification Settlement Agreement.		
Priority 4	Metropolitan Water District of Southern California (MWDSC) for coastal plain of Southern California--550,000 af/yr.	
Priority 5	An additional 550,000 af/yr to MWDSC, and 112,000 af/yr for the City and County of San Diego [c].	
Priority 6	Imperial Irrigation District and lands served from the All-American Canal in Imperial and Coachella Valleys, and Palo Verde Irrigation District for use on 16,000 acres in the Lower Palo Verde Mesa, for a total not to exceed 300,000 af/yr.	
Total of Priorities 1 through 6 is 5.362 maf/yr.		
Priority 7	All remaining water available for use in California, for agricultural use in California's Colorado River Basin.	
b. Indian tribes and miscellaneous present perfected right holders that are not identified in California's Seven Party Agreement have the right to divert up to approximately 85 taf /yr (equating to about 50 taf/yr of consumptive use) within California's 4.4 maf basic apportionment. These users are presently consumptively using approximately 32 taf/yr (assuming about 25 taf/yr of unmeasured return flow).		
c. Subsequent to execution of the Seven Party Agreement, San Diego executed a separate agreement transferring its apportionment to MWDSC.		

Table 11-3
SWP Contractors in the Colorado River Region

Agency	Maximum Annual Amount (taf)	SWP Deliveries in 2000 (taf)
Coachella Valley Water District	23.1	42.3
Desert Water Agency	38.1	58.2
Mojave Water Agency (a)	75.8	11.2
San Gorgonio Pass Water Agency	17.3	0
a Maximum Annual Amounts include amounts for both the South Lahontan and Colorado River Regions; 7.3 taf of this amount is allocated to Colorado River Region.		

Neither Coachella Valley Water District (CVWD) nor Desert Water Agency (DWA) has facilities to take direct delivery of SWP water. Instead, both agencies have entered into exchange agreements with Metropolitan Water District of Southern California (MWDSC), whereby MWDSC releases water from its Colorado River Aqueduct into the Whitewater River for storage in the upper Coachella Valley groundwater basin. In exchange, MWDSC takes delivery of an equal amount of the agencies' SWP water. San Gorgonio Pass Water Agency (SGPWA), which serves the Banning-Beaumont area, also lacks the facilities to take delivery of SWP water into the portion of its service area which is within the Colorado River Region. However, SGPWA is currently delivering SWP water into the Santa Ana Planning Area of the South Coast Hydrologic Region. When Phase 2 of the East Branch Extension is completed, water will be delivered into the Colorado River Hydrologic Region; however, the Department is still planning for that Phase.

Groundwater provides about 7.5 percent of the water supply in normal years and about 7.7 percent in drought years (DWR 1998). Groundwater storage capacity is reported for 40 of the region's 57 groundwater basins and is estimated to be more than 175 maf. Imperial Valley, the largest water-using area in the region, does not have significant supplies of usable groundwater.

In the Coachella Valley, groundwater levels have been declining since 1945. Imported water supplies from the Colorado River via the Coachella Canal have enabled decreased pumping of groundwater in the southeastern portion of the Valley and helped recharge the basin. In response, groundwater levels rose in this part of the Valley. However, in the 1980s, these levels began to decline again because of urban development and increased groundwater pumping.

Local water districts have been implementing programs to address the decline in groundwater levels. The move by CVWD and DWA to bring in SWP supplies was an important first step. In 1984, an agreement was reached among CVWD, DWA, and MWDSC that allowed for the advanced deliveries of Colorado River water supplies to the Coachella Valley during periods of high flows on the River. These supplies helped accelerate the pace of replenishment of the basin and provided water supplies for future uses.

Under the agreement, MWDSC was also permitted to bank approximately 600,000 acre-feet of supplies in the basin. When the need arises for these supplies, MWDSC will take its Colorado River water along with CVWD's SWP allocations until the quantity of banked water supplies is exhausted.

In 2000, the estimated applied water demands for urban, agriculture, and the environment for the Colorado River Region were 4,775 taf. Most of the demands are for agriculture, approximately 85 percent. In 2000, the estimated applied water demand for agriculture was 4,071 taf.

Almost all of the agricultural demands in the Region occur in the three major agricultural areas described earlier, the Imperial, Palo Verde, and Coachella Valleys. The Imperial Valley, with over 500,000 acres of crops harvested each year, accounts for almost 70 percent of the total applied water demands for the region. In 2000, the applied demands for agriculture in the Imperial Valley were 2,911 taf.

Most of the agricultural demands are met with water supplies from the Colorado River. In the Coachella Valley, agricultural demands are met through a combination of Colorado River and groundwater supplies.

Urban applied water demands account for about 15 percent of the overall totals for the Colorado River Region. In 2000, urban demands were estimated to be 673 taf. Most of these demands occur in the Coachella Valley ; 527 taf in 2000 or almost 80 percent of the total applied water for the region. Existing housing and commercial uses have been augmented by large housing tracts with lavish landscaping, hotels, shopping centers, country clubs, golf courses, and polo fields. Landscape irrigation demands in the Coachella Valley are large because of the large expanse of turf grass and landscaping that have occurred in the last two decades.

Despite the availability of reliable and inexpensive water supplies, water districts and users are cognizant of the importance of implementing water conservation programs to effectively use and manage these supplies. For the past 50 years, the Imperial Irrigation District (IID), the region's largest water district, has implemented programs and completed projects designed to improve the efficiency of its water conveyance system. Under the IID/MWD Water Conservation Agreement, and Approval Agreement (December 1989), 15 new projects were completed including the construction of 3 lateral interceptors serving over 83,400 acres, the construction of 2 regulatory reservoirs and 4 interceptor reservoirs, concrete-lining of nearly 200 miles of lateral canals, and installation of new hardware and software to upgrade the existing telemetry equipment on its conveyance system (with a state-of-the-art Water Control Center). These infrastructure upgrades complimented existing IID programs such as the 13- and 21-Point Water Conservation Programs, irrigation scheduling and training services, and canal seepage recovery programs.

In addition to the improvements to its water conveyance system, the IID provides technical assistance to its agricultural customers through its Irrigation Management Services program Its most valued service has been the dissemination of information to farmers and irrigation personnel on methods to improve their irrigation operations. Moreover, the program is actively involved in the use and deployment of the following methodologies and instruments to improve irrigation efficiencies: level basin drip systems, level basin laser-leveling, irrigation scheduling, utilization of portable pump-back and tailwater return systems, salinity assessment, soil moisture sensors, and tailwater meters.

Excluding the water supply savings in the IID/MWD agreement, improvements to the water distribution and other water conservation techniques save over 600,000 acre-feet of supplies annually. Of this amount, the IID estimates that close to 400,000 acre-feet of the savings are attributable to the efforts by its agricultural customers.

The CVWD has also made important improvements to its water conveyance system. Water supplies are delivered to its agricultural customers through underground pipelines and are metered. The conveyance system is computerized which adds to the operational efficiency of the system. In addition to the infrastructure improvements, CVWD provides technical services to its agricultural and residential customers on efficient irrigation management practices.

The districts have also examined their water operation policies and procedures. This review has resulted in modifications in the delivery procedures that have improved efficiencies and assisted local farmers in their attempts to implement irrigation scheduling activities.

For the PVID, telemetry controls have been installed for over 132 key control structures which has improved the management of water supplies in its canal system. Most of the fields in the Valley have been laser-leveled With the fields being flat, with no slope, tailwater flows from the fields are eliminated. All deliveries to the PVID's retail agricultural customers are measured.

PVID, in conjunction with the University of California Cooperative Extension and DWR, has installed three CIMIS stations to collect the necessary climatological data to help its agricultural water users in estimating crop ETAW and develop irrigation schedules. Water users are made aware of improvements in irrigation management and crop growing procedures through a local Progressive Farmers group.

To assist the CVWD, the PVID entered into an emergency six month fallowing program in 2003. Over 16,417 acres of farmland was idled and the unused water supplies, 41 taf, was transferred to CVWD.

The IID, PVID, and CVWD are signatories to the Memorandum of Understanding Regarding Efficient Water Management Practices by Agricultural Water Suppliers in California. By signing the MOU, the water districts reaffirmed and demonstrated their intentions to adopt and implement agricultural water management plans that would serve and benefit the agricultural water management activities within their service areas.

As mentioned earlier, growers in the major agricultural areas are utilizing the latest irrigation hardware and management techniques to increase both the efficiencies of their operations and crop yields. In the Imperial Valley, it is not uncommon to see drip, micro-sprinklers, and drip tape systems being utilized along with the traditional systems of furrow, basin, and hand-move sprinklers. The drip tape is most commonly used for high-market value crops such as vegetables. Drip and micro-sprinkler systems are commonly used to irrigate the citrus and subtropical fruit orchards; less than 1 percent of the acres (mainly date palms) are flood irrigated.

Most irrigation operations with vegetables and truck crops in Coachella Valley utilize drip tape and hand moved sprinklers. Some furrow irrigation is still being used. Citrus and subtropical fruit orchard irrigations are handled mainly with drip and micro-sprinklers; although flood or basin irrigation is still being used for mature date palms. Almost all the vineyards are being irrigated by some type of drip system; only a very small portion still rely on furrow irrigation. The use of overhead sprinkler systems is still a common sight in vineyards throughout the valley. They are used for frost protection and the inducement of vine dormancy for earlier fruit-sets.

Although most of the water conservation activities have been directed to agriculture, water districts in the Coachella Valley are providing technical assistance to the managers of the large landscaped areas, such as golf courses, to evaluate and offer suggestions for improvement for the irrigation hardware and operations at their facilities. The Coachella Valley Water District provides loans to its retail customers for irrigation system upgrades. Desert Water Agency offers classes, in English and Spanish, to homeowners, property management personnel, and government and school personnel on irrigation efficiency strategies and tools.

The largest water body in the region is the Salton Sea, a saline lake with a concentration of total dissolved solids of approximately 45,000 mg/L, or 25 percent greater than that of ocean water. Most of the environmental water demands in the region are for the Sonny Bono Salton Sea National Wildlife Refuge, DFG Imperial Wildlife Area, and wetland areas on the shore of the Salton Sea. The Salton Sea ecosystem is considered a critical link on the international Pacific Flyway, providing wintering habitat for migratory birds, including some species whose diets are based exclusively on fish.

The following water balance table (Table 11-4) summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, imports make up a substantial portion of the water supply in the region. See Table 11-4**:** Colorado River Hydrological Region Water Balance Summary.

State of the Region

Challenges

Threatened or endangered fish species on the mainstem of the Colorado River include the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail chub. Restoration actions to protect these fish may affect reservoir operation and streamflow in the mainstem and tributaries. Other species of concern in the basin include the bald eagle, Yuma clapper rail, black rail, southwestern willow flycatcher, yellow warbler, vermilion flycatcher, yellow-billed cuckoo, and Kanab ambersnail.

In 1993, the United States Fish and Wildlife Service (UFSWS) published a draft recovery implementation plan for endangered fish in the upper Colorado River Basin. The draft plan included protecting instream flows, restoring habitat, reducing impacts of introduced fish and sportsfish management, conserving genetic integrity, monitoring habitat and populations, and increasing public awareness of the role and importance of native fish.

Problems facing native fish in the mainstem Colorado River and its tributaries will not be easily resolved. For example, two fish species in most danger of extinction, the bonytail chub and razorback sucker, are not expected to survive in the

Salton Sea Ecosystem

The Salton Sea, a saline lake with a total dissolved solids of approximately 45,000 mg/L -- 25 percent greater than that of ocean water -- is California's largest (surface area) lake and has been famous for its sport fishing and other recreational uses. It is also a federally and state designated repository to receive and store agricultural, surface, and subsurface drainage waters from the Imperial and Coachella Valleys. Water imported from the Colorado River has created an irrigated agricultural ecosystem in the watershed. Consequently, wildlife and aquatic species, which are dependent upon habitat created by the discharge of agricultural return flows, are threatened by the salinity of the Sea, which is increasing at a rate of approximately one percent per year. The Sea's importance to wildlife has grown as approximately 95 percent of California's wetlands have disappeared because of changes in land use.

The Salton Sea ecosystem, including the Sonny Bono Salton Sea National Wildlife Refuge, is considered a critical link on the International Pacific Flyway for migratory birds. The amount of freshwater inflow that will be available to the Sea is considered uncertain due to water transfers within the United States and water conservation both in the United States and in Mexico.

wild. In recent years most stream and reservoir fisheries in the basin have been managed for non-native fish. These management practices have harmed residual populations of natives. Many native fish are readily propagated in hatcheries, and thus recovery programs include captive broodstock programs to maintain the species. Reestablishing wild populations from hatchery stocks will have to be managed in concert with programs to manage river habitat. For example, although 15 million juvenile razorback suckers were planted in Arizona streams from 1981-90, the majority of these planted fish were likely eaten by introduced predators. In 1994, the states of Colorado, Wyoming, and Utah reached an agreement with USFWS on protocols for stocking non-native fish in the Upper Basin. Stocking protocols are consistent with native fish recovery efforts. In a program, which began in 1989, USBR and other state and federal agencies have cooperated to capture, rear, and successfully reintroduce about 15,000 razorback sucker larvae in Lake Mohave.

Instream flows in the mainstem and key tributaries are being evaluated as components of native fish recovery efforts. State and federal agencies are conducting studies to estimate base flow and flushing flow needs for listed and sensitive species in various river reaches.

In the Lower Colorado River Basin, representatives of the three states, federal agencies, several Native American Tribes, and Colorado River water and power users are in the final stages of development of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The LCR MSCP is intended to provide long-term compliance with the federal and California Endangered Species Acts.

The LCR MSCP is a 50-year program that would provide over 8,100 acres of high quality aquatic, wetland, and native broadleaf riparian habitat along the Lower Colorado River from Lake Mead to the Southerly International Boundary with Mexico. The restored and maintained habitats would provide ecological benefits and mitigate potential impacts to 26 covered species being addressed within the LCR MSCP. Some of the proposed habitat restoration may involve the conversion of existing agricultural lands to native riparian habitats, as well as removal of non-native salt cedar (tamarisk) and replacement with native broadleaf riparian habitat (e.g., cottonwood, willow, and mesquite, etc.).

Additionally, the LCR MSCP participants plan to rear and repatriate to the mainstream over 660,000 razorback suckers and 620,000 bonytail during the 50-year implementation period of the LCR MSCP. Over 360 acres of backwater habitats would be created along the Lower Colorado River to provide nursery habitat for juvenile native fish and additional wetland habitat for marsh species and migratory waterfowl.

California’s Colorado River water and power using agencies and entities are participants in the LCR MSCP planning process. The LCR MSCP is expected to begin implementation in early 2005. The Bureau of Reclamation, in conjunction with representatives of the three states and the U.S. Fish and Wildlife Service, will be the agency primarily responsible for implementing the LCR MSCP during the 50-year period.

The Salton Sea, with its increasing salinity, selenium, and eutrophication, is the primary focus of international water quality issues in the Colorado River region. The largest sources of the Sea’s inflow are the New and Alamo Rivers and the Imperial Valley Agriculture Drains, which contribute pesticides, nutrients, selenium, and silt. These contamination problems in particular present threats to migrating birds on the Pacific Flyway. The most polluted river in the U.S., the New River actually originates in Mexicali

(Mexico), flows across the International Boundary, through the city of Calexico, and then northward, emptying into the Salton Sea. It conveys urban runoff, untreated and partially treated municipal and industrial wastes, and agricultural runoff from the Mexicali and Imperial Valleys. These pollution sources contribute pesticides, pathogens, silt, nutrients, trash, and VOCs (primarily from Mexican industry) to the Sea. The Alamo River, which originates just two miles south of the border and also flows northward to the Salton Sea, consists mainly of agricultural return flows from the Imperial Valley. Pathogens are also problematic in the Palo Verde Outfall Drain, which drains back into the river, and the Coachella Valley Stormwater Channel, which drains to the Sea. At some times of the year, nutrient loading to the Sea supports large algal blooms that contribute to odors, as well as low dissolved oxygen levels that adversely affect fisheries. Selenium is a more recent constituent of interest, potentially affecting fish and wildlife. Water conservation measures to facilitate water transfers to the South Coast could dramatically increase the levels of selenium, which is primarily from the Colorado River and subsurface (tile) drainage discharges to the Sea.

The relatively saline Colorado River provides irrigation and domestic water to much of southern California. Of recent human health concern are the presence of low levels of perchlorate in the Colorado River (from the Las Vegas Wash), and hexavalent chromium at very high levels in wells at Needles near the River. The Colorado's perchlorate contamination originates at a site in the Las Vegas Wash and is the nation's largest. Septic systems at recreational areas along the Colorado are also a concern for domestic and recreational water uses. Other important water quality issues in this region include increasing levels of salinity, nitrates and other substances in groundwater associated with animal feeding and dairy operations and septic tank systems, especially in the Desert Hot Springs area and in the Cathedral City Cove area. In the Coachella Valley, nitrates have restricted the use of several domestic water supply wells.

To address the issue of declining groundwater levels, CVWD and DWA have prepared a groundwater management plan for the lower valley. They have considered alternatives that include basin adjudication, water conservation, water recycling, and direct or in lieu recharge with water imported from the Colorado River or from the SWP. The plan was completed in 2002.

As a result of the 1964 U.S. Supreme Court decree in Arizona v. California, California's basic apportionment of Colorado River water was quantified and five lower Colorado River Indian Tribes were awarded 905 taf of annual diversions, 131 taf of which were allocated for diversion in and chargeable to California pursuant to a later supplemental decree.

In 1978, the tribes asked the Court to grant them additional water rights, alleging that the U.S. failed to claim a sufficient amount of irrigable acreage, called omitted lands, in the earlier litigation. The tribes also raised claims called boundary land claims for more water based on allegedly larger reservation boundaries than had been assumed by the court in its initial award. In 1982, the Special Master appointed by the Supreme Court to hear these claims recommended that additional water rights be granted to the Indian tribes. In 1983, however, the U. S. Supreme Court rejected the claims for omitted lands from further consideration and ruled that the claims for boundary lands could not be resolved until disputed boundaries were finally determined.

Three of the five tribes – the Fort Mojave Indian Tribe, the Fort Yuma-Quechan Indian Tribe, and the Colorado River Indian Tribe – are pursuing additional water rights related to the boundary lands claims.

A settlement has been reached on the claim of the Fort Mojave Indian Tribe, and a settlement may soon be reached on the claim of the Colorado River Indian Tribe. Both settlements would then be presented to the Special Master. The claim of the Fort Yuma-Quechan Indian Tribe has been rejected by the Special Master on the grounds that any such claim was necessarily disposed of as part of a Court of Claims settlement entered into by the tribe in a related matter in the mid1980s. As with all claims to water from the mainstem of the Colorado River and any determination by the Special Master, only the U.S. Supreme Court itself can make the final ruling.

If both the Fort Mojave and the Colorado River Indian Tribe settlements were approved, the tribes would receive water rights in addition to the amounts granted them in the 1964 decree.

Accomplishments

There have been several large-scale water conservation actions involving Colorado River water users, as shown in Table 11-4.

Table 11-4
Existing Colorado River Region Water Conservation Actions

Year	Action	Participants	Comments/Status	Estimated Savings
1980	Line 49 miles of Coachella Branch of All American Canal	USBR, CVWD, MWDSC	Project completed.	132 taf/yr
1988	IID distribution system improvements and on-farm water management actions	IID, MWDSC	Multi-year agreement, extends into 2033. Projects MWDSC has funded include canal lining, regulatory reservoir and spill interceptor canal construction, tailwater return systems, non-leak gates, 12-hour delivery of water, drip irrigation systems, linear-move irrigation systems, and system automation. MWDSC has funded over $150 million for conservation program costs through 1997.	107 taf/yr in 1998
1992	Groundwater banking in Arizona	MWDSC, CAWCD, SNWA	Test program to bank up to 300 taf.	MWDSC and SNWA have stored 139 taf in Arizona groundwater basins.
1992	PVID land fallowing	PVID, MWDSC	Project completed. Two-year land fallowing test program. Covered 20,215 acres in PVID.MWDSC paid $25 million to farmers over a two-year period.	Total of 186 taf was made available from the program, although the water was subsequently released from Lake Mead when flood control releases were made from the reservoir.
1995	Partnership agreement	USBR, CVWD	Provides, among other things, for studies to optimize reasonable beneficial use of water in the district.	N/A
1998	Water transfer agreement	IID, SDCWA	Initial terms of 45 years and renewal terms of 30 years.	10 taf/yr in 2003 to 200 taf/yr in 2022 and thereafter.
2003	Land lease agreement	PVID, CVWD	PVID conserved and transferred water supplies to CVWD.	40.6 taf in 2003.
2004	Land fallowing	PVID, MWDSC	35-year land fallowing program.	Proposal for PVID to make up to 111 taf/yr of water supplies available to MWDSC.

Relationship with Other Regions

Although the facilities to deliver SWP water supplies to the region have yet to be constructed, CVWD and DWA receive their annual allocations of SWP water through an exchange agreement with the South Coast Region’s largest water wholesale agency, MWDSC. These districts are also participants in another agreement that delivers and stores water supplies from the Colorado River in the Coachella Valley’s largest groundwater basin during periods of high flows.

Water districts in both regions are also cooperating in water conservation and land fallowing programs. The 1988 IID/MWDSC Water Conservation Agreement resulted in the conservation of water supplies from the construction of new facilities, water system automation, and the implementation of technical assistance programs for farmers within the IID water service area. The conserved water is delivered to MWDSC.

MWDSC and PVID are negotiating the terms for a 35-year land fallowing, crop rotation, and water supply agreement. A certain percentage of lands normally farmed in the Palo Verde Valley would be fallowed each year. Water supplies for these lands would be delivered to MWDSC. Some of these supplies would be used to facilitate the transfer agreement between SDCWA and the IID.

Looking to the Future

During 2002 and 2003, the California Colorado River water agencies, working through the Colorado River Board of California, have been developing a proposal for discussion with the other basin states to illustrate how, over time, California would reduce its use to the basic apportionment of 4.4 maf/yr. A draft of the proposal, prepared by the Colorado River Board is entitled "California's Colorado River Water Use Plan" (Water Use Plan), has been shared with the other six basin states. The last official draft of the document was May 11, 2000. Efforts are currently underway to update the document.

As currently formulated, the Water Use Plan would be implemented in two phases. The first phase (between the present and 2010 or 2015) includes improved system and reservoir management, such as the interim surplus guidelines and canal lining, to reduce California's Colorado River water use to about 4.6 to 4.7 maf/yr. The second phase would implement additional measures to reduce California's use to its basic annual 4.4 maf apportionment in those years when neither surplus water nor other states' unused apportionments were available. One of the fundamental assumptions made in the plan is that MWDSC's Colorado River Aqueduct will be kept full, by making water transfers from agricultural users in the Colorado River Hydrologic Region to urban water users in the South Coast Hydrologic Region.

The agricultural water purveyors in the region (IID, PVID, CVWD, and Bard Water District) will continue to implement Efficient Water Management Practices. Water districts in the Coachella Valley will continue with their efforts to provide technical assistance to the managers of large landscape areas to help improve the efficiencies of irrigation operations.

CVWD will continue to work with DWA to address the declining water levels in the Coachella Valley’s largest groundwater basin, the Indio sub-basin. They are operating an active groundwater recharge program for the upper end of the Coachella Valley (generally, the urbanized part of the valley). CVWD recharges groundwater with imported Colorado River supplies and with Whitewater River flows using percolation ponds. CVWD and DWA levy extraction fees on larger groundwater users in the upper Coachella Valley.

With support from the Quechan Indian Reservation, Bard Water District (BWD) is undertaking an $8 million project for capital improvements on the Reservation Division of the U.S. Bureau of Reclamation's Yuma Project. This improvement project is in large part funded by a $4 million matching grant from the North American Development Bank. The Quechan Indian Reservation contributed $2 million of the matching funds and $2 million were raised by BWD customers BWD is rehabilitating approximately 10 miles of earthen canals with concrete lining and pipeline in 2004 and an additional 10 miles are to be rehabilitated in 2005 BWD will also be replacing over 100 irrigation gates and structures. These improvements will greatly increase the effectiveness of its system by reducing water losses from seepage and evaporation.

Over the years, the Bureau of Reclamation and others have considered potential solutions to stabilize the Salton Sea's salinity and elevation. Most recently, the Salton Sea Authority has been performing appraisal level evaluations of some of the frequently suggested alternatives, such as large scale pump-in, pump-out pipelines to the Pacific Ocean. The Authority is currently investigating integrated strategies where a smaller, lower salinity lake with a stable water surface would be coupled with treatment/desalination of some brackish inflows. The treated water could then be sold or could be part of a water transfer that would help fund the project.

Key Elements of California's Colorado River Quantification Settlement Agreement

The California Colorado River Quantification Settlement Agreement will have the following effects:

- Have California adopt specific, incremental steps to gradually reduce its use of Colorado River water over the next 14 years to its basic annual apportionment of 4.4 million acre feet.
- Provide Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming with certainty on use of the river, allowing them to take their full apportionments to meet future water needs.
- Permits the utilization of interim surplus water stored in Lake Mead.
- Transfer as much as 30 million acre-feet of water from farms to cities in Southern California over the 75-year term of the deal.
- Settle a lawsuit between the Imperial Irrigation District and the Interior Department, alleging that the District was wasting water.
- Launch an ambitious plan to reduce rising salinity in the Salton Sea, a massive, agricultural sump straddling Riverside and Imperial counties that is an important stopping point for migratory birds.
- Provide for $163 million to offset the environmental impacts of the water transfer in the arid Imperial Valley and help fund the cost of restoring the Salton Sea.
- Fund a $200 million project to line, with concrete, the earthen All-American Canal, which delivers Colorado River water to the Imperial Valley, with concrete. Water conserved by reducing seepage will be sold to San Diego.
- Quantify, for the first time, the total Colorado River apportionments among water districts within California.

Adapted from The Associated Press. "Key elements of Colorado River water deal." October 17, 2003.

The Colorado River Quantification Settlement Agreement (QSA), finalized in October 2003, outlines key elements for California to operate within its basic annual allotment of 4.4 maf from the Colorado River.

Water Portfolios for Water Years 1998, 2000, and 2001

Above average rainfall occurred during Water Year 1998. For Water Years 2000 and 2001, rainfall totals were below average; 2000 could be considered a dry year. In Water Year 1998, rainfall totals averaged 176 percent above average for the NWS station in Blythe, 104 percent of average for the El Centro 2 SSW station and 108 for Palm Springs.

Water Year 2000 was very dry. Rainfall totals measured by the Blythe station for the year were only 17 percent of average; for El Centro, 10 percent of normal; and for Palm Springs, 35 percent of normal. Conditions improved slightly for Water Year 2001. The Blythe station measured rainfall that was 120 percent of normal. For El Centro, it was 78 percent of normal and for Palm Springs, it was 74 percent.

Despite the climatological conditions, demands for water supplies by the region’s urban and agricultural users and the environment did not exhibit any large fluctuations during the period. The total applied water demand for 1998 was 4,604 taf. For 2000, the demands increased slightly to 4,775 taf, and for 2001, it was 4,668 taf.

Minor reductions in the irrigated crop acres occurred from 1998 to 2000, followed by a slight increase for 2001. Totals for the region were 761,760 acres in 1998, 731,890 acres for 2000, and 739,830 for 2001. Noticeable declines were noted for the irrigated grains and other field crop categories. A steady increase was noted for the vegetables crops classified in the Other Truck category.

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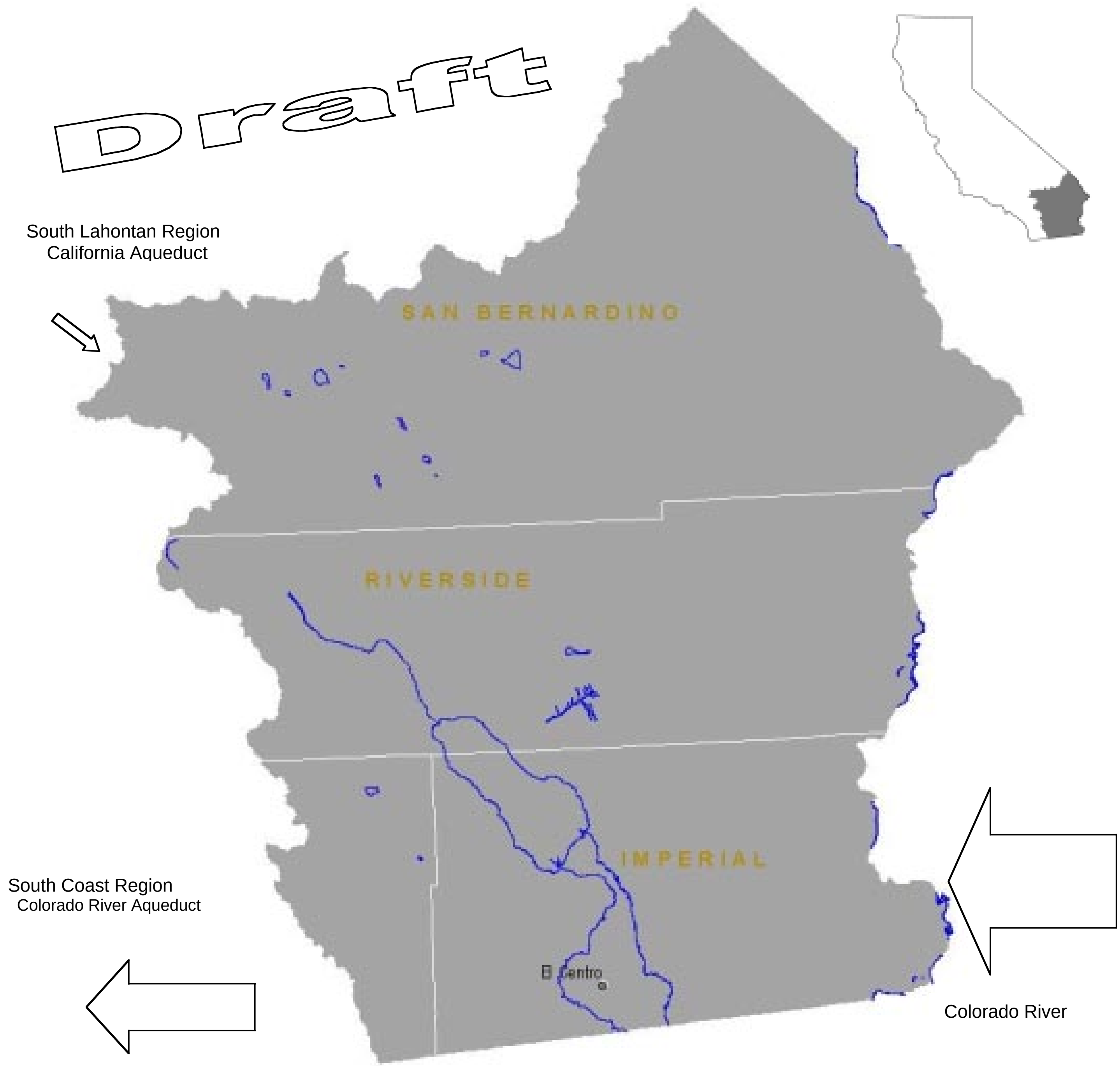
Figure 11-1
Colorado River Region



Some Statistics

- Area - 19,962 square miles (12.6% of State)
- Average annual precipitation – 5.7 inches
- Year 2000 population - 606,090
- 2030 projected population –
- Total reservoir storage capacity - 620 TAF
- 2000 irrigated agriculture - 628,550 acres

Table 11-5
Colorado River Region Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	9,455	3,034	4,770
Inflow from Mexico	182	166	155
Inflow from Colorado River	3,905	4,053	3,947
Imports from Other Regions	5,143	5,449	5,193
Total	**18,685**	**12,702**	**14,065**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	2,795	2,940	2,831
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	1,081	1,296	1,202
Statutory Required Outflow to Salt Sink	0	0	0
Additional Outflow to Salt Sink	1,273	1,279	1,245
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	13,609	7,395	8,987
Total	**18,758**	**12,910**	**14,265**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	-15	-19	1
Change in Groundwater Storage **	-58	-189	-201
Total	**-73**	**-208**	**-200**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	4,132	4,346	4,290

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 11-6
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	Colorado River 1998 (TAF)				Colorado River 2000 (TAF)				Colorado River 2001 (TAF)				Data Detail
		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	
Inputs:														
1	Colorado River Deliveries		3,904.9				4,052.8				3,946.9			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		182.4				165.6				154.7			PSA/DAU
5	Precipitation	9,454.8				3,033.9				4,769.9				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		6.6				6.3				4.0			PSA/DAU
10	Local Imports		-				-				-			PSA/DAU
11a	Central Valley Project :: Base Deliveries		-				-				-			PSA/DAU
b	Central Valley Project :: Project Deliveries		-				-				-			PSA/DAU
12	Other Federal Deliveries		-				-				-			PSA/DAU
13	State Water Project Deliveries		156.4				100.6				43.9			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		-				-				-			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		-				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetlands		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		-				-				-			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		-				-				-			PSA/DAU
b	Recycled Water - Urban		16.0				17.2				17.8			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		-				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		145.4				161.0				211.9			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		78.5				84.6				76.6			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		-				-				-			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		119.9				132.3				135.3			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		-				-				-			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		-				-				-			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	580.8				585.4				566.9				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	254.3				304.4				307.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	N/A				N/A				N/A				REGION
30	Surface Water Storage - End of Yr	566.3				566.9				568.3				PSA/DAU
31	Groundwater Recharge-Contract Banking		-14.7				-59.2				-8.9			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				1,555.5				1,552.5				1,552.4	REGION
b	Evaporation from Reservoirs				120.0				121.5				120.6	REGION
36	Ag Effective Precipitation on Irrigated Lands		-				-				-			REGION
37	Agricultural Use		3,570.5	3,372.1	3,372.0		3,732.4	3,515.5	3,515.4		3,663.6	3,451.7	3,451.7	PSA/DAU
38	Wetlands Use		31.6	31.6	31.6		30.2	30.2	30.2		29.6	29.6	29.6	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		84.4				108.5				147.6			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		121.7				119.8				90.4			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		20.3				10.2				9.7			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		14.3				9.5				10.1			PSA/DAU
40	Urban Commercial Use		48.0				96.0				151.3			PSA/DAU
41	Urban Industrial Use		3.3				4.7				4.9			PSA/DAU
42	Urban Large Landscape		161.2				157.5				105.7			PSA/DAU
43	Urban Energy Production		76.7				76.7				76.7			PSA/DAU
44	Instream Flow		-	-	-		-	-	-		-	-	-	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		-	-	-		-	-	-		-	-	-	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				2,466.1				2,617.9				2,594.8	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				31.6				30.2				29.6	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				297.2				292.1				206.2	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				90.7				89.7				85.6	PSA/DAU
50	Urban Waste Water Produced	59.8				66.5				68.2				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				37.1				24.3				18.9	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				64.0				64.0				64.0	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				N/A				N/A				N/A	PSA/DAU
52a	Return Flows to Salt Sink - Ag				1,089.8				1,082.4				1,045.9	PSA/DAU
b	Return Flows to Salt Sink - Urban				183.2				196.1				198.9	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				-				-				-	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	5,142.6				5,449.4				5,192.8				REGION
56	Regional Exports	1,081.3				1,296.0				1,202.0				REGION
59	Groundwater Net Change in Storage	-57.6				-188.5				-200.7				REGION
60	Surface Water Net Change in Storage	-14.5				-18.5				1.4				REGION
61	Surface Water Total Available Storage	620.4				620.4				620.4				REGION

Colored spaces are where data belongs. N/A Data Not Available "-" Data Not Applicable "0" Null value

Table 11-7
Colorado River Region Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	161.2			157.5			105.7		
Commercial	48.0			96.0			151.3		
Industrial	3.3			4.7			4.9		
Energy Production	76.7			76.7			76.7		
Residential - Interior	104.7			118.7			157.3		
Residential - Exterior	136.0			129.3			100.5		
Evapotranspiration of Applied Water		297.2	297.2		292.1	292.1		206.2	206.2
Irrecoverable Losses		73.9	73.9		81.3	81.3		83.0	83.0
Outflow		122.9	122.9		129.0	129.0		130.4	130.4
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
GW Recharge Applied Water	132.9			90.5			39.5		
GW Recharge Evap + Evapotranspiration		23.5	23.5		10.1	10.1		4.4	4.4
Total Urban Use	**662.8**	**517.5**	**517.5**	**673.4**	**512.5**	**512.5**	**635.9**	**424.0**	**424.0**
Agriculture									
On-Farm Applied Water	3,570.5			3,732.4			3,663.6		
Evapotranspiration of Applied Water		2,466.1	2,466.1		2,617.9	2,617.9		2,594.8	2,594.8
Irrecoverable Losses		90.7	90.7		89.7	89.7		85.6	85.6
Outflow		815.2	815.2		807.8	807.8		771.3	771.3
Conveyance Losses - Applied Water	338.6			338.6			338.6		
Conveyance Losses - Evaporation		64.0	64.0		64.0	64.0		64.0	64.0
Conveyance Losses - Irrecoverable Losses		167.6	167.6		167.6	167.6		167.6	167.6
Conveyance Losses - Outflow		107.0	107.0		107.0	107.0		107.0	107.0
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**3,909.1**	**3,710.6**	**3,710.6**	**4,071.0**	**3,854.0**	**3,854.0**	**4,002.2**	**3,790.3**	**3,790.3**
Environmental									
Instream									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Wild & Scenic									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	31.6			30.2			29.6		
Evapotranspiration of Applied Water		31.6	31.6		30.2	30.2		29.6	29.6
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	31.6	31.6	31.6	30.2	30.2	30.2	29.6	29.6	29.6
Total Environmental Use	**31.6**	**31.6**	**31.6**	**30.2**	**30.2**	**30.2**	**29.6**	**29.6**	**29.6**
TOTAL USE AND LOSSES	**4,603.5**	**4,259.7**	**4,259.7**	**4,774.6**	**4,396.7**	**4,396.7**	**4,667.7**	**4,243.9**	**4,243.9**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	6.6	6.6	6.6	6.3	6.3	6.3	4.0	4.0	4.0
Local Imported Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colorado River Deliveries	3,904.9	3,904.9	3,904.9	4,052.8	4,052.8	4,052.8	3,946.9	3,946.9	3,946.9
CVP Base and Project Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Federal Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SWP Deliveries	156.4	156.4	156.4	100.6	100.6	100.6	43.9	43.9	43.9
Required Environmental Instream Flow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Groundwater									
Net Withdrawal	175.8	175.8	175.8	219.8	219.8	219.8	231.3	231.3	231.3
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	78.5			84.6			76.6		
Reuse/Recycle									
Reuse Surface Water	265.3			293.3			347.2		
Recycled Water	16.0	16.0	16.0	17.2	17.2	17.2	17.8	17.8	17.8
TOTAL SUPPLIES	**4,603.5**	**4,259.7**	**4,259.7**	**4,774.6**	**4,396.7**	**4,396.7**	**4,667.7**	**4,243.9**	**4,243.9**
Balance = Use - Supplies	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 11-2
Colorado River Region 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

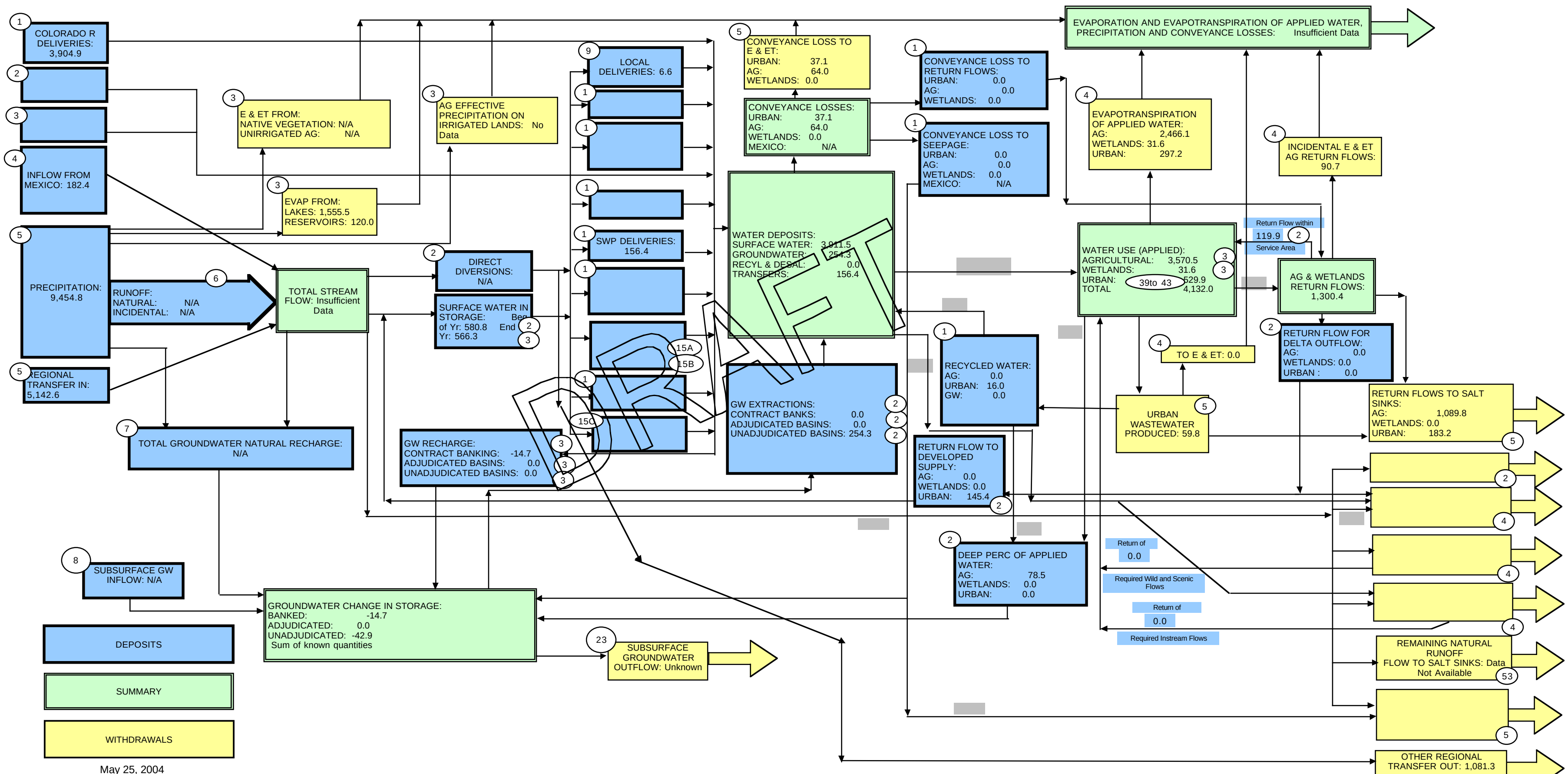


Figure 11-3
Colorado River Region 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

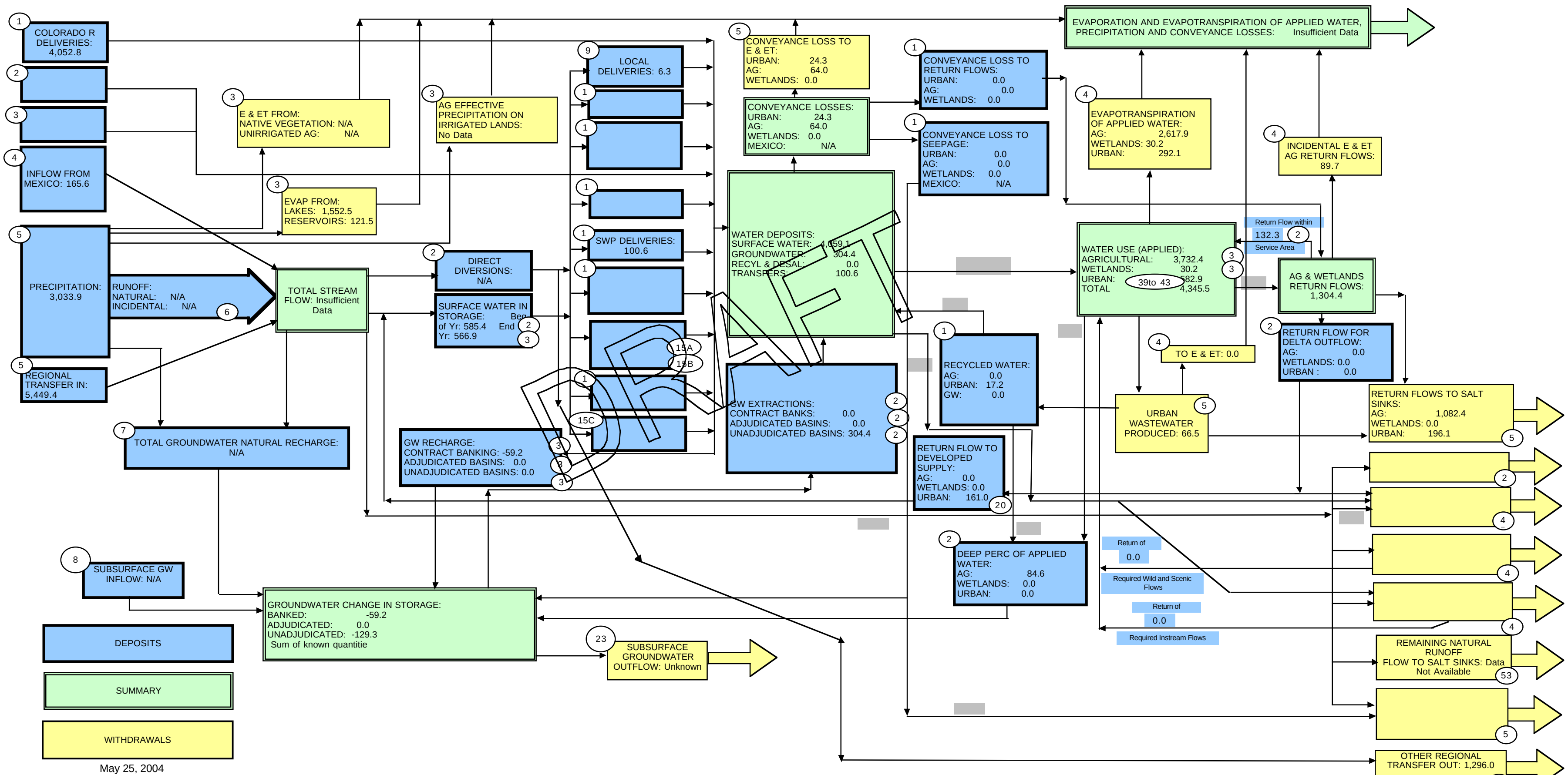
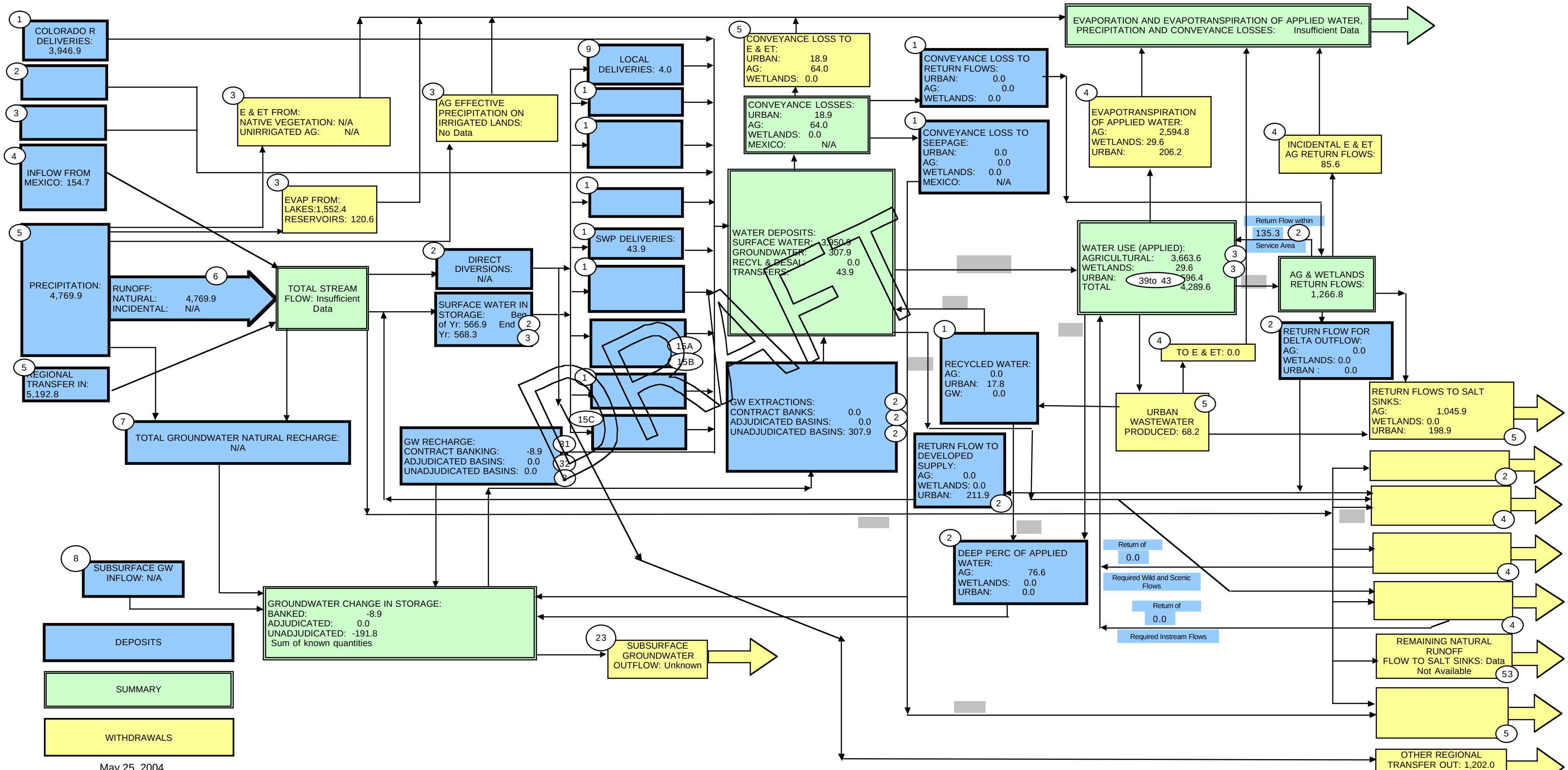


Figure 11-4
Colorado River Region 2001 Flow Diagram
In Thousand Acre-Feet (TAF)



Chapter 12. Sacramento-San Joaquin Delta Region

Setting

Until 1850, the Delta was wild, a tidal marsh with islands and river channels that changed according to nature's will. By the 1870s, settlers had built levees and turned marshland into farmland. Farming on a commercial scale became a way of life. The 1870s and 1880s saw arrival of commercial fisheries that introduced non-native species—striped bass and American shad. In the same era, commerce grew, and with the vessels transporting goods to market came invasive species unintentionally carried to the Delta in the ballast water of these vessels. By 1951, with completion of the Delta-Mendota Canal, the Delta was forever changed. This federal project for moving water to California's Central Valley farms was the start of water supply infrastructure that would evolve to today's multi-billion dollar system. Now, this massive network of canals, weirs, pumps, and fish screens moves water to farms, industries, and residents hundreds of miles from the Delta. What was once a continually changing tidal marsh is now a complex maze of natural and man-made resources providing multiple benefits to California's water users and the economy. The challenge the region faces in the 21st century is how to sustain the viability of these resources while demand for them continues to grow.

Background

This profile of the Delta Region is an overview of current efforts to carry out actions that will allow the region to continue to serve society's demand for farm products, fishing, recreation, and water—all while protecting the Delta's ecosystem and water quality. The intent of the profile is to give readers a sense of the region's water resource management priorities and outline major efforts by CALFED and others to integrate water resource management activities in the Delta.

The California Bay-Delta Authority became a state agency in January 2003. The authority will oversee implementation of the CALFED Bay-Delta Program to improve water supplies in California and the health of the San Francisco Bay–Sacramento/San Joaquin River Delta.

The mission of the CALFED Bay-Delta Program is to develop and implement a long-term, comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system.

- The major water-related challenges facing the
- Delta are reflected in the CALFED Program
- priorities and issues for the Region:
- Preserve a viable agricultural base.
- Maintain strong levees.
- Protect water quality for agricultural and urban water users in and around the Delta.
- Protect and increase recreational opportunities.
- Restore healthy ecosystems to benefit native species.

These goals incorporate the four broad CALFED resource management objectives of water supply reliability, water quality, ecosystem restoration, and levee system integrity, and respond to concerns expressed by stakeholders and the Delta Protection Commission (DPC).

Authorized by the Delta Protection Act of 1992, the DPC is the regional entity charged with protecting the natural, agricultural, and recreational resources of the Delta. The Act required the DPC to develop and adopt a resource management plan for the *primary zone* of the Delta (defined in Public Resources Code Section 29728) The DPC's mission is to guide the protection of the Delta's unique natural quality, cultural viability, economic viability, and recreational opportunities using three main objectives:

The Delta Protection Commission was created by State Legislation in 1992 with the goal of developing regional policies for the Delta to protect and enhance the existing land uses in the 500,000 acre Primary Zone: agriculture, wildlife habitat and recreation. In 2000, the Commission was made a permanent State agency.

- Protection, maintenance, and enhancement and restoration of the overall quality of the Delta environment including agriculture, wildlife habitat, and recreational activities;
- Assurance of orderly, balanced conservation and development of Delta land resources; and
- Improvement of flood protection to ensure an increased level of public health and safety.

The CALFED Program and the DPC recognize that activities of the CALFED Ecosystem Restoration, Conveyance, Storage, and Levee System Integrity program elements must be in concert with the Delta Region's land use and recreation objectives. Therefore, CALFED and the DPC coordinate activities on a regular basis.

Geography and Climate

The Sacramento-San Joaquin Delta is a unique and valuable resource and an integral part of California's water system. Located at the confluence of the Sacramento and San Joaquin Rivers, the Delta is part of the largest estuary system on the West Coast and is the keystone to operation of the two largest water projects in California_the State Water Project and the federal Central Valley Project. The region extends from the confluence of the two rivers inland to Sacramento and Stockton and spans roughly 750,000 acres. A large part of this land is below sea level, and relies on more than 1,100 miles of levees for protection against flooding along the hundreds of miles of interlaced waterways.

The Delta boundary was first defined in 1959 with the passage of the Delta Protection Act. California Water Code Section 12220 contains the legal description of the Delta.

The Delta's network of waterways conveys runoff from over 40 percent of California's land area. Water from rivers of California's Great Central Valley flows to the Pacific Ocean through the Delta. Major tributaries include the Sacramento, San Joaquin, Calaveras, Cosumnes, and Mokelumne Rivers. These rivers plus their tributaries carry 47 percent of the State's total runoff.

Land Use

The vast majority of the Delta land is agricultural (about 538,000 acres). Because of the rich peat soils and the abundant supply of water, these acres are among the most highly productive land in the world. Principal crops grown include corn, grain, alfalfa, pasture, asparagus, tomatoes, fruit, nuts, and safflower. Open water covers about 60,000 acres, while urban and commercial property comprises approximately 64,000 acres. The remainder of the region presently consists of undeveloped natural plant vegetation.

Population

According to the census figures used in the 1995 Sacramento-San Joaquin Delta Atlas, the population in the Delta was an estimated 410,000 in 1990. The legal Delta encompasses portions of six counties: Alameda, Contra Costa, Sacramento, San Joaquin, Solano and Yolo. Current data from the California State Census Data Center for areas of these counties within the legal Delta indicate about 461,000 people reside in the Delta Region. (Figure 1 shows a map of current population estimates for each of the county areas within the legal Delta.) Rapid growth is occurring in urban areas in and surrounding the Delta, including West Sacramento, Sacramento, Elk Grove, Lathrop, Stockton, Tracy, Brentwood, Oakley, Discovery Bay, Mountain House, Antioch, Pittsburg, and Rio Vista.

Water Use

Water use in the Delta Region is mostly agricultural, with over 4,000 cubic feet per second of surface water diverted from Delta channels during peak summer months to irrigate crops. Currently there are roughly 1,800 sites where agricultural water is pumped onto the Delta islands, and the total volume of pumped water is about 1 million acre-feet annually. The main crops grown in the Delta are alfalfa, asparagus, corn, fruit, grain and hay, pasture, safflower, sugar beets and tomatoes. Most Delta farms use water taken directly from Delta sloughs and rivers under riparian water rights, and drainage water from the islands is pumped back into the Delta waterways. Small communities in the Delta primarily use groundwater wells for their water needs, and urban water use in the Delta only accounts for a small percentage of the total developed supply. The remaining portion of water in the Delta goes to wildlife habitat, salinity control, and other environmental uses. Recreation uses are also important in the Delta, with an estimated 12 million “user days”[1] recorded each year for recreation purposes.

Water Exported from the Delta

Water flowing through the Delta is the major source of fresh water inflow to the San Francisco Bay. The Delta also provides a portion of the water supply for many communities in the Bay region. Water exported southwards from the Delta provides drinking water for roughly two-thirds of the state’s population (over 22 million people) and irrigation water for more than four million acres of farmland statewide. Larger diversions from the Delta include the State Water Project (Banks Pumping Plant and the North Bay Aqueduct), Central Valley Project (Tracey Pumping Plant), and Contra Costa Water District. Table 1 provides a water balance that summarizes the major water sources entering and leaving the Delta.

The boundaries of the Delta were legally defined by the Delta Protection Act of 1959 (California Water Code Section 12220) and it is composed of The Uplands Zone (lands above the five-foot elevation contour) and The Lowlands Zone (lands at or below the five-foot contour line). The statutory Delta

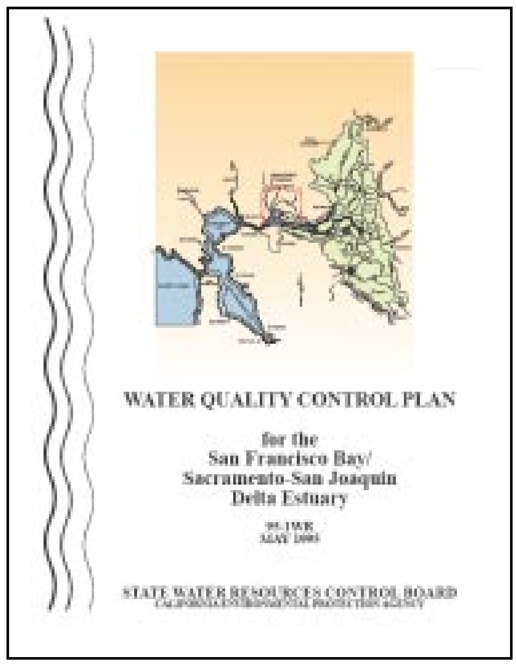
[1] A “user day” is a measure of the number of people visiting or using a site over part or all of a given day. Since some recreation users will visit recreation areas more than once each year, the total number of people using recreation facilities over a year in the Delta is less than 12 million.

Boundary that defines the Legal Delta is shown on the following map, along with actual water inflows, outflows, uses and exports for an average water year (2000).

Delta Water Standards

Requirements of the State Water Resource Control Board (SWRCB) govern release of upstream flows and curtailment of export pumping to maintain Delta water quality and the outflow requirements to the San Francisco Bay. The first water quality standards for the Delta were adopted in May 1967, when the State Water Rights Board (predecessor to the SWRCB) released Water Right Decision 1275, approving water rights for the State Water Project while setting agricultural salinity standards as terms and conditions. These requirements were altered in 1971 under Decision 1379 (D-1379), which added standards the CVP and SWP are to meet for non-consumptive uses (water dedicated to fish and wildlife), along with agricultural, municipal, and industrial consumptive use standards. In 1978, the SWRCB issued D-1485 and the 1978 Delta Plan, which together revised flow and salinity standards and required the US Bureau of Reclamation (USBR) and Department of Water Resources (DWR) to reduce pumping, release stored water upstream, or both to meet the standards.

In 1986, Congress passed the CVP-SWP Coordinated Operation Agreement (Title I of PL 99-546), which included requirements that the CVP be operated in coordination with the SWP to meet state water quality standards in the Delta. Also in 1986, the Supreme Court upheld the Racanelli Decision, which recognized SWRCB authority and discretion over water rights and water quality issues, including authority over CVP operations. As a result of increasing use of Delta waters combined with escalating environmental and fishery problems, the SWRCB adopted a new Bay-Delta Plan in 1991, which included objectives for salinity, dissolved oxygen, and temperature. The United States Environmental Protection Agency (EPA) followed with federal standards for the Estuary through EPA regulations in 1994. In December of 1999, the SWRCB issued a new Decision 1641 as a part of the1995 Bay-Delta Water Quality Control Plan, which replaced earlier Delta standards and conditioned the water rights permits of the SWP and CVP to implement the new objectives. The requirements set in D-1641 covered Phases 1 – 7 of the Bay-Delta Water Rights Hearings. In April of 2001, the SWRCB went on to adopt Water Rights Order 2001-05, which facilitates negotiations to settle the responsibilities for implementing and maintaining the 1995 WQCP.



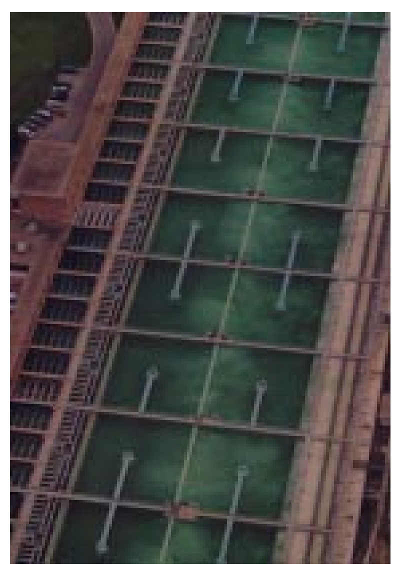
Currently the SWP and the CVP coordinate project operations to maintain the standards established by D-1641, by releasing water from upstream reservoirs for Delta outflow requirements, and by curtailing export pumping at the SWP Banks and CVP Tracy Pumping Plants during the specified time periods. This combination of Delta outflow requirements and export pumping limitations impose the most difficult challenges to the process of transporting water from upstream reservoirs to meet water needs in the San Joaquin Valley and Southern California.

State of the Region

The complex resource issues of the Delta will continue to require extensive planning, coordination and management, so that all interests who benefit from the Delta can participate in the vast array of projects intended to improve water supply, water quality, ecosystem health, and levee stability. In the initial years of the CALFED Stage 1 program, CALFED activities in the Delta have focused on ecosystem restoration, levee stability, and drinking water quality. Efforts toward coordination and integration of multiple objectives are proceeding. Interest groups and government agencies are continuing to develop a package interdependent actions and programs that will protect the Delta's water quality and ecosystem, and keep the levee system stable. The California Bay-Delta Authority is working with the Delta Protection Commission to carry out actions and programs set forth in the CALFED Bay-Delta Program, a comprehensive plan for addressing ecosystem health and water supply reliability problems in the Bay-Delta. Currently, CALFED agencies are working on what's called the *Delta Improvements Package* under which technical knowledge gained from scientific and engineering studies is used to determine how best to sequence interrelated actions outlined in the CALFED plan. Among the many challenges of this effort is the issue of how to reconcile the engineering and technical realities with the economic and political realities.

Water Quality

The Delta is a source of drinking water for over 23 million Californians, which presents many challenges, particularly in terms of water quality. Salinity and bromide (from saltwater intrusion and agricultural drainage), organic carbon, and pathogens, major constituents of concern for water agencies, are all found in the Delta. Treatment of water containing organic carbon and bromide can create disinfection byproducts that may be harmful to human health. Increasing population adds additional pressures on the Delta system due to greater recreational use and increased wastewater discharges, both of which can impact water quality. Agricultural discharges within the Delta have been shown to contribute a significant part of the organic carbon load in water currently diverted by the export pumps. In addition, some of the proposed CALFED projects for water supply and ecosystem restoration may unintentionally contribute to water quality degradation.



Water quality is also a concern for agricultural and environmental interests. Good water quality is critical for the state's agricultural sector and for the fish and wildlife in the Bay and Delta. The entire Delta is on the SWRCB's 303(d) list2 for sources of mercury, which becomes concentrated in fish tissue. A variety of pesticides and chlorpyrifos are also present in the Delta. South Delta agricultural diverters are often faced with high levels of salinity, which can damage crops and reduce productivity. Low dissolved oxygen in the Stockton Deepwater Ship Channel, also on the 303(d) list, is a long-standing problem that has resulted in harm to aquatic life and may pose a barrier to fall-run salmon migrating upstream to spawn. Dredging to maintain the Stockton and Sacramento deepwater ports may re-suspend contaminants (from sediment) that are toxic to

[2] The Clean Water Act requires that states and territories identify impaired and threatened water bodies that are not expected to meet water quality standards, as outlined in Section 303(d) of the Act. These lists result in the development of Total Maximum Daily Loads (TMDLs), which establish the maximum amount of pollutants the water body can receive while still meeting water quality standards.

aquatic life. Vessel discharges of wastes may also contribute to loadings of pathogens and other pollutants.

The CALFED Drinking Water Quality Program is evaluating projects to improve Delta water quality, including relocating agricultural drains and reducing pollutant loads from agricultural drainage. In 2003, this program invested $1.7 million in four drinking water quality projects to monitor and assess organic carbon sources and processes in the Delta. Efforts to model water quality improvements that could be provided by conveyance and storage alternatives are also underway, and monitoring of salinity and dissolved oxygen levels is taking place in several parts of the Delta. Besides the Drinking Water Quality Program, other initiatives are also addressing water quality concerns. The CALFED Ecosystem Restoration Program has invested $10.1 million in six ecosystem restoration projects that include water quality benefits. In addition, the California Bay-Delta Authority and several other agencies are supporting an effort led by the Central Valley Regional Water Quality Control Board to develop a drinking water policy for the Valley Region that will protect the Delta as a drinking water source well into the future.

Ecosystem Restoration

Over the past century, the health of the Delta ecosystem has declined in response to a loss of habitat for both aquatic and terrestrial biota. Remaining habitat quality has also declined due to several factors including water diversions, toxic pollutants, and the introduction of exotic species. In fact, few aquatic ecosystems in North America have been invaded and changed by as many exotic species as those in the Bay-Delta. The Delta no longer provides the broad diversity or quality of habitat necessary to maintain ecological functions and support healthy populations of native plants and animals. Conversion of agricultural land to accommodate ecosystem improvements under the Bay-Delta Program could provide some relief, but these actions are also a major concern for Delta agricultural interests, who rely on the land for their economic survival.

During the past several decades, as water diversions and the recognition of environmental water needs have increased, so have the conflicts among different interests. Water flow and timing requirements have been established for certain fish and wildlife species in response to declining fish and wildlife populations. These requirements restrict the amount of water that can be diverted from the Delta, and constrain the time over which these withdrawals can be made. Over the past decade, a number of other protective actions have been implemented, including the Central Valley Project Improvement Act (CVPIA) and the 1994 Bay-Delta Accord, which have reduced the ability of the CVP and SWP to meet the water demand of their contractors at the times supplies are needed. This timing issue has contributed to the false perception of a zero-sum game, in which ecosystem or water supply interests can only benefit at the other’s loss, and has created heightened tension between various groups.

To address ecosystem health issues, the CALFED Ecosystem Restoration Program (ERP) has invested in cooperative projects such as wildlife-friendly agricultural practices, which have shown that different interest groups do not have to compete against each other to prosper in the Delta. Other ecosystem efforts underway include wetlands protection studies, invasive species eradication initiatives, and fish studies to monitor the effects of pesticides on aquatic health. About $155 million has been spent on 107 ecosystem projects in the Delta, representing one of the largest investments in ecosystem restoration in the United States. The ERP has also funded major studies to examine the effects of pesticides on fish in the Bay-Delta system and the release of dissolved organic carbon and methyl mercury from restored wetlands.

Levee System Integrity

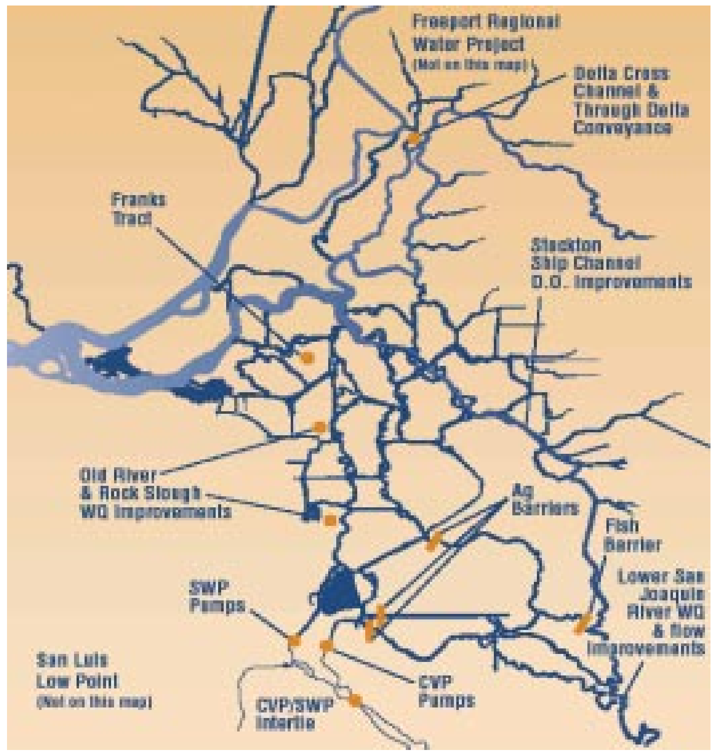
The Delta levees confine flow to channels and protect Delta lands from daily flooding by the tidal fluctuations. Without the levees, the Delta would be a 740,000-acre brackish inland sea. Since the late 1800s, levees have been built from the peat soils native to the Delta. This material is weak and highly compressible, and the use of native peat soils to construct Delta levees has left many of them vulnerable to failure, especially during earthquakes or floods. The high organic content in the soil contributes to rapid decomposition and settling, and decreases the integrity of the levee structures and their ability to hold back water flows. Delta island farmland, residential land and homes, wildlife habitat, and critical infrastructure would be flooded as a result of a levee failure. Flooding in the Delta has historically resulted in millions of dollars of damages. The State formed a partnership with Delta Levee Maintaining Agencies to improve the condition of the extensive Delta levee system. As a result of that partnership, risks have been mitigated to some extent with the implementation in 1986 of a new levee maintenance assistance program, and incidents of levee failure from winter floods have decreased since that time.

Levee failures during the summer or fall that inundate islands under non-flood conditions can also cause impacts by pulling salty water up into the Delta. The increased salinity in the Delta could shut down CVP and SWP exports from the Delta. The increased salinity in the Delta would be of particular concern in a low water year, when less freshwater is available to flush the salt out of the Delta. This damaging scenario occurred in 1972, when the Brannan-Andrus Island levee failed, resulting in the loss of about 400,000 acre-feet of water supplies and requiring the removal of about 50 tons of salt. Long-term flooding of specific Delta islands could also affect water quality over a longer time horizon by changing the rate of saltwater intrusion and the area of the mixing zone. A long interruption of water supply for in-Delta and export use affecting both urban and agricultural users could result, until the salt water could be flushed from the Delta.

In addition to levee maintenance and enlargement, other levee-related efforts include levee subsidence studies, emergency response coordination (including the distribution of flood fight boxes containing emergency materials such as sandbags and hand tools), analysis of levee risks associated with seismic events, and dredged material management. The Levee System Integrity efforts have incorporated a number of ecosystem-related projects, such as the habitat development work currently underway at Decker Island, and certain provisions of the Program require that levee activities must result in net habitat improvement. Other agencies involved with the Delta Levee efforts include the U.S. Army Corps of Engineers and the California Department of Fish and Game.

Water Supply Reliability

Since the Delta water users divert directly out of adjacent channels running through the Delta, they normally have immediate access to water. However, water levels in the channels are influenced by CVP and SWP operations, especially diversions at the south Delta export pumps. Lower water levels in the south Delta make it difficult for local irrigators to pump or siphon the water from the channels to their farmlands. Moreover, the flow of water to the export pumps can draw water with a higher salinity into the south Delta from the western Delta.

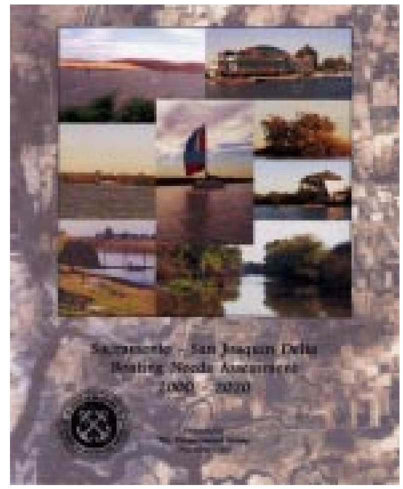


To help address the water level problem, CALFED agencies provide assistance in creating temporary barriers in portions of the Delta to raise water levels for irrigators. Other site-specific actions enable easier water diversions. Longer-term solutions involving the installation of permanent operable barriers are being analyzed as part of the South Delta Improvements Program (SDIP), which would enable increasing pumping operations at Banks Pumping Plant to 8,500 cubic feet per second during longer periods of the year. Design and environmental reviews of the SDIP are progressing. Other water supply activities in the Delta currently under investigation by CALFED include adding an intertie between the CVP and SWP canals, re-operating the Delta Cross-Channel (DCC) for the benefit of fish and water quality, and feasibility studies for an in-Delta storage project. Thus far, modeling studies for the CVP-SWP intertie and two years of research experiments on DCC re-operation have been completed. In addition, a draft report about the engineering feasibility of the in-Delta storage project has been published for review.

Recreation

According to figures used in the 1995 Sacramento-San Joaquin Delta Atlas, the Delta was estimated to support 12 million recreational user days a year. According to surveys conducted in 1996 by the Delta Protection Commission (DPC)and the Department of Parks and Recreation (DPR), 23.5 percent of registered boat owners and 23 percent of

licensed anglers in the State of California participated in recreation activities in the Delta. Fishing, cruising, water skiing, swimming, and sailing are all popular ways of recreating in the Delta, as well as sightseeing and wildlife viewing. Given the growing population trends across the state, and the popularity of the Delta as a major recreational location, recreation use in the Delta is likely to increase along with other services.



The DPC, DPR, and the Department of Boating and Waterways (DBW) are important to Delta recreation. In addition to the 1996 surveys, DBW cooperated with DPC’s Recreation Citizen’s Advisory Committee in December of 2002 to produce a Boating Needs Assessment, inventorying existing recreational boating infrastructure in the Delta and projecting future boating needs. This assessment followed a 1995 Report conducted by DPC, which made recommendations to improve recreation conditions and access. Funding to prepare a detailed Delta Recreation Master Plan has not materialized yet. However, the studies that have been conducted and the estimates of recreation use in the Delta indicate that recreation is a key component in management of Delta resources. As a public resource and economic benefit, recreation opportunities in the Delta are highly valued.

Looking to the Future

A wide variety of studies and projects are underway to improve water supply reliability and protect water quality, ecosystem health, and the stability of levees in the Delta. Most of these activities are being conducted by state and federal agencies in partnership with local landowners and Delta interests, and many of the major projects are critical to implementing the CALFED Bay-Delta Program Plan.

This year, CALFED implementing agencies are working towards agreement with Delta interests about the *Delta Improvements Package* to move critical projects forward so that CALFED objectives can be achieved. These projects are outlined in the CALFED Bay-Delta Program Record of Decision (ROD), which calls for balanced implementation of CALFED program elements. In the Delta Region, implementation of the CALFED resource management objectives includes: improving the environment so that threatened and endangered species populations can recover; making continual improvements in Delta water quality; increasing conveyance capacity of the Delta pumping plants (to improve water supply reliability statewide); assuring adequate water levels for agricultural diverters; and improving levee system integrity. The Delta Improvements Package is a framework for moving forward in each of these areas simultaneously. For example, although the CALFED ROD did not require that Delta water quality improvements occur before increasing the pumping capacity of Delta pumping plants, DWR and USBR are working with Delta interests to improve salinity levels in the south Delta while proceeding with studies for the South Delta Improvements Program (SDIP).

Following is a summary of major programs and actions that will benefit the Delta Region. These programs are critical to achieving major project milestones established for Stage 1 (years 1 through 7) of the CALFED Bay-Delta Program. Successful completion of these efforts will lay the foundation for sustainable water resource management in the Delta for the next generation.

Water Quality

The Bay-Delta Authority has an integrated water quality program to address a series of water quality issues throughout the Delta and Central Valley. Several individual projects have been identified for implementation as part of the program. The goals and objectives of this program include:

- Continuously improving Delta water quality for all uses
- Addressing all dissolved oxygen and salinity impairments in the Delta
- Addressing other existing water quality impairments that may be affected by proposed actions
- Perform recirculation studies as required by D-1641
- Address habitat and hydraulic issues on Frank's Tract
- Address State and Regional Water Resources Control Board regulatory requirements:
    - Meeting current water quality protection terms and conditions in water right permits
    - Impacts evaluation of proposed actions and development of needed mitigation measures
    - Develop response plans addressing potential impacts from increased diversions caused by Joint Points of Diversion, applications for additional diversions, petitions to add points of diversion or change place of CVP or SWP use, long and short term water transfer petitions, Section 401 water quality certifications, and others as required.

See the appendix for brief descriptions of water quality projects that will help achieve the above goals and objectives.

Ecosystem Restoration

The Delta Regional Ecosystem Restoration Implementation Plan is currently being prepared by the Department of Fish and Game in cooperation with the Bay-Delta Authority. The CALFED ERP Program is committed to developing and refining the regional implementation plan for the Delta. The ERP expects to refine and prioritize actions during the regional planning process, and to vet the scientific foundation for actions and milestones. Regional plans for most of the Delta Region and part of the Suisun Marsh (in the Bay Region) are underway. The Delta Protection Commission provides guidance and input to this planning process.

Ongoing Planning Efforts

- American Farmland Trust study of Delta agriculture.
- DFG Ecosystem Restoration Plan for the Delta.
- SAFCA study of new flood control projects for Sac and West Sac in Yolo Bypass.
- Yolo Flyway Center --proposed public education facility adjacent to Yolo Bypass.
- Delta Science Center--proposed public education facility at Big Break Regional Shoreline (East Bay Regional Park District).
- Rio Vista--proposed public education and recreation facility at former military property recently transferred to City of Rio Vista.
- New Research Facility proposed by CALFED Science Consortium at former military property recently transferred to City of Rio Vista.
- Delta Protection Commission proposed study of Delta recreation
- California Bay-Delta Authority, various investigations for implementation of the Bay-Delta Plan

The DPC has also partnered with the American Farmland Trust to prepare an inventory of Delta agriculture resources and their economic value. This inventory will help identify lands that should receive additional attention and/or protection. The resulting DPC plan could help in the implementation of the CALFED ecosystem restoration goal of protecting and enhancing 45,000-75,000 acres of wildlife friendly agriculture in the Delta.

Water Supply Reliability

The North Delta Improvement Program (NDIP) will provide ecosystem and flood control improvements. The stated purpose of the NDIP is to implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. To improve the conveyance facilities in the north Delta for water quality and fishery improvements without incurring water supply disruptions, DWR and USBR, in cooperation with the CALFED Science Program, will continue to conduct studies and experiments to provide a solid basis for future possible Delta Cross Channel (DCC) re-operations. Simultaneously, DWR is refining concepts for a *Through-Delta Facility* to improve water quality conditions in the South Delta without impacting fish by transporting 4,000 cfs of water from the Mokelumne River to the South Delta.

The South Delta Improvements Program (SDIP) is being carried out by DWR and USBR. Actions contemplated as part of the SDIP include providing for more reliable long-term export capability for the SWP and CVP, protection of local diversions, and reducing impacts on San Joaquin River salmon. Increasing SWP pumping at Banks Pumping Plant to 8,500 cubic feet per second and installing permanent, operable barriers in the south Delta will improve water supply reliability for the SWP, CVP, and local agricultural diversions in the Delta.

DWR and USBR are also investigating the In-Delta Storage Project as part of the Bay-Delta Program. Two Delta islands would be modified to store a total of about 217,000 acre-feet for a wide variety of potential uses, including exports and Delta outflow.

Levee System Integrity

[Editor’s note: levee system update being developed]

Recreation

For Delta recreation, DPC has coordinated an Ad Hoc Recreational Committee of agencies and interested parties/stakeholders to develop a recreation vision and plan to be incorporated into the Bay-Delta Program.

Sources of Information

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- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board.
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- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000.
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- Delta Atlas, State Department of Water Resources, July 1995.
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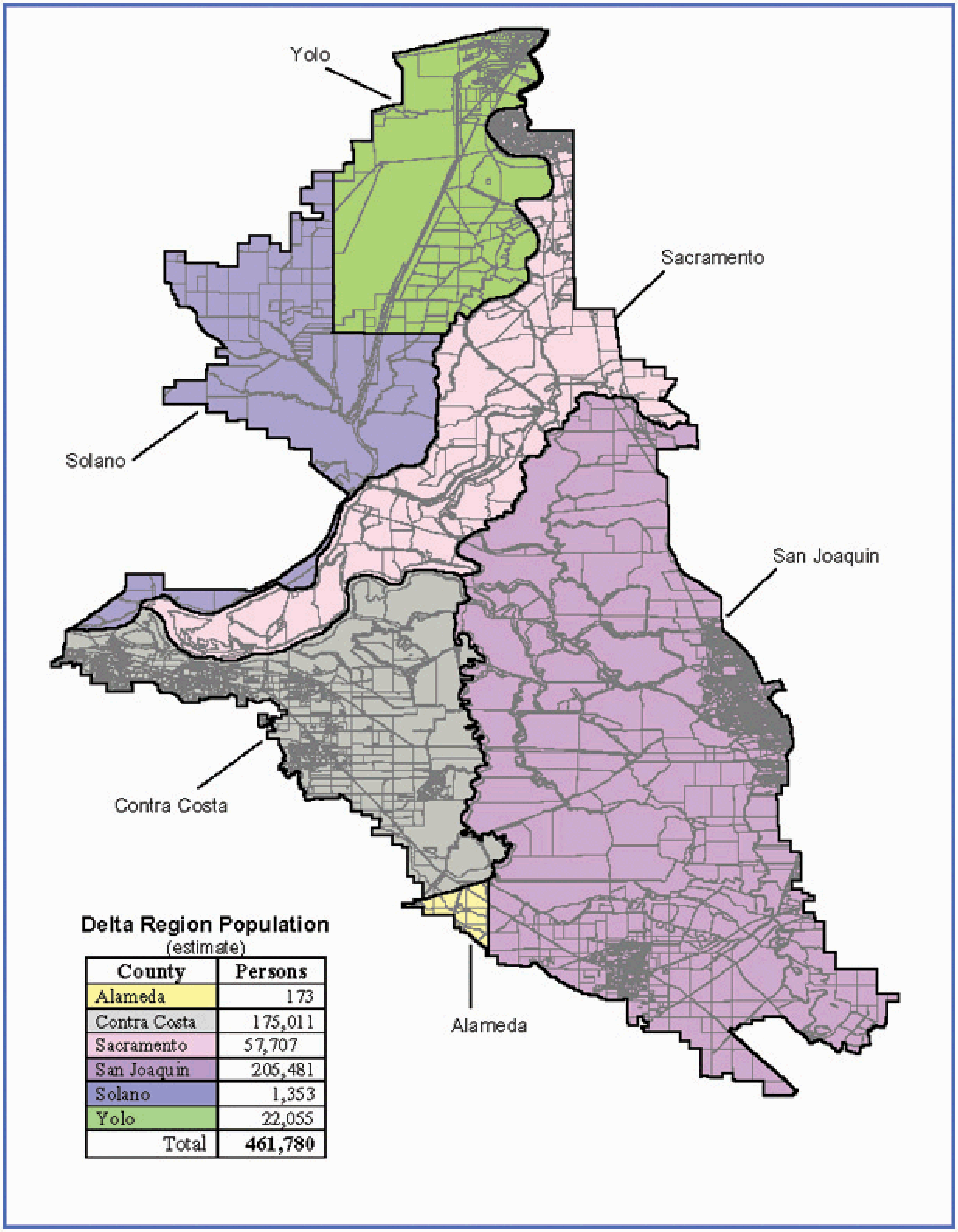
- Delta Primer, a field guide to the California Delta, Jane Wolff, William Stout Publishers, San Francisco, 2003.
- 2003 Annual Report, California Bay-Delta Authority.

Figure 12-1
Delta Region Population



County	Persons
Alameda	173
Contra Costa	175,011
Sacramento	57,707
San Joaquin	205,481
Solano	1,353
Yolo	22,055
Total	**461,780**

Figure 12-2
Delta Water Balance

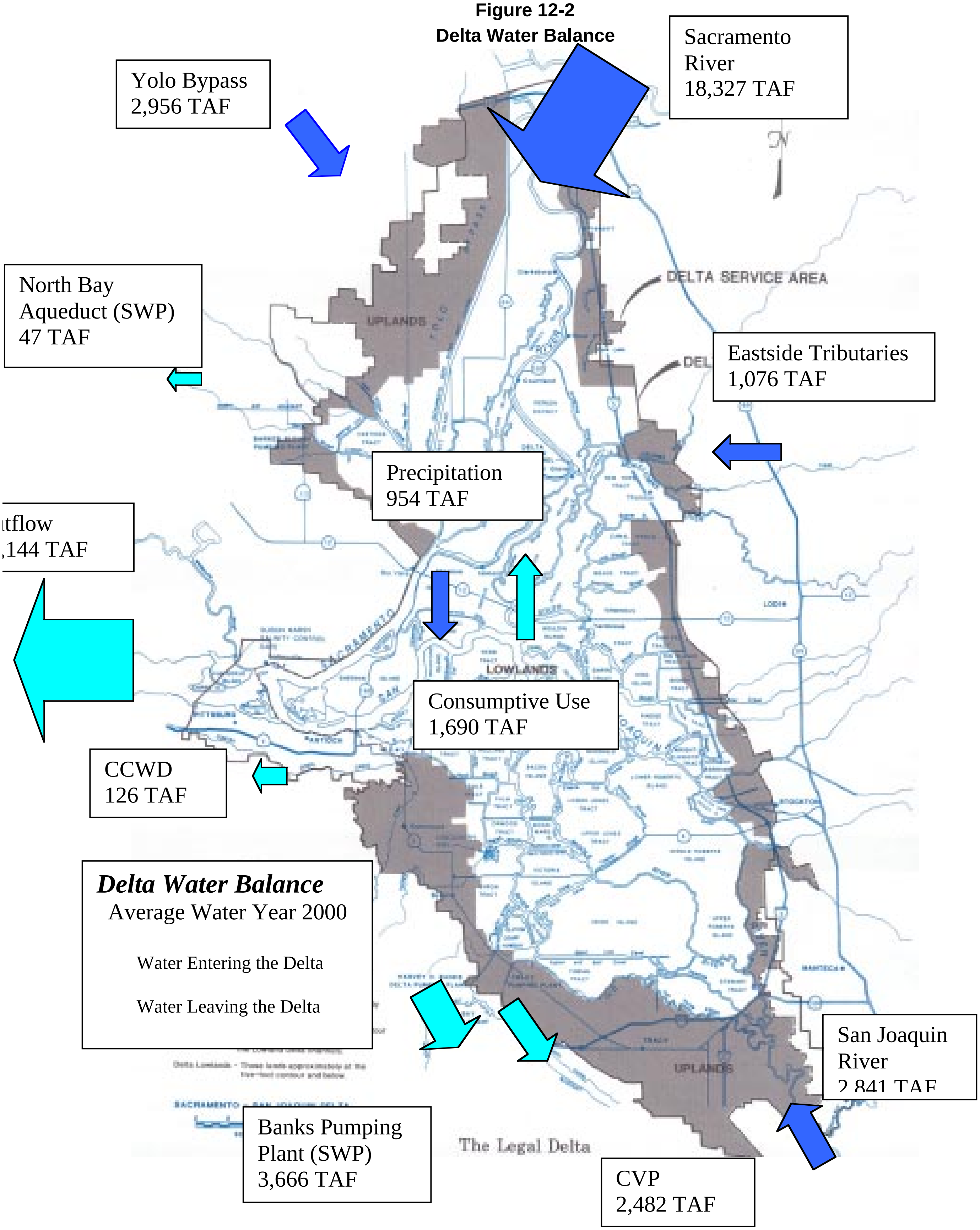


Table 12-1
Water Balance for the Delta Region (IEP Dayflow Data)

Table 1. Water Balance for the Delta Region (IEP Dayflow Data)			
	1,000s of Acre Feet		
	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	1,421	954	762
Sacramento River	28,964	18,327	10,499
Yolo Bypass (incl. Sac. Weir spill and South Putah Cr.)	8,980	2,956	366
San Joaquin River	8,441	2,841	1,729
Cosumnes River	785	372	116
Mokelumne River	969	360	127
Misc. Eastside Tribs.	339	344	128
Total	49,899	26,155	13,727
Water Leaving the Region			
Consumptive Use (Gross Channel Depletion for Ag, M&I, Wetlands, ET)	1,688	1,690	1,688
SWP Exports			
Banks Pumping Plant	2,111	3,666	2,599
North Bay Aqueduct	39	47	45
CVP Exports	2,470	2,482	2,328
Contra Costa WD Exports	160	126	104
Outflow to Bay/Ocean	43,430	18,144	6,963
Total	49,899	26,155	13,727

Chapter 13. Mountain Counties Area of California

Setting

The Mountain Counties Area of California includes the foothills and mountains of the western slope of the Sierra Nevada and a portion of the Cascade Range. The area extends from the southern tip of Lassen County to the northern part of Fresno County (see Figure 13-1) and covers the eastern portions of the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions. The foothill and mountain areas of these three hydrologic regions are grouped together for the purpose of presenting their common characteristics.

The area generally includes all or portions of Shasta, Lassen, Plumas, Butte, Sierra, Yuba, Nevada, Placer, El Dorado, Amador, Alpine Calaveras, Tuolumne, Mariposa, Madera, and Fresno, counties. Elevations vary from around 100 feet near the edge of the valley floor to more than 10,000 feet at locations along the Sierra Nevada and Cascade Range crestline. The major rivers in the area include the Sacramento, Pit, Feather, Yuba, Bear, and American Rivers in the Sacramento River Region; the Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, Fresno, and San Joaquin Rivers in the San Joaquin River Region; and the Kings, Kaweah, Tule, and Kern Rivers in the Tulare Lake Region.

Climate

The climate is closely tied to the topography and varies widely throughout the area; mean annual precipitation ranges from more than 80 inches at Strawberry Valley, east of Lake Oroville, to less than 12 inches at Fresno County. Much of the precipitation falls as snow in the higher elevations in the winter. Water managers throughout the area rely on this natural storage as snow in the winter months and capture and/or divert spring snowmelt runoff.

Population

The 2000 population of the area was about 542,000, less than 2 percent of the state total population. However, the effects of urbanization are beginning to impact some of the foothill areas. Population growth in the area from 1990 to 1995 was almost 10 percent. The State’s growth rate during the same 5-year period was about 7 percent. Although total population in the area is low, the area’s rate of growth is projected to continue to outspace that of the state as a whole. The projected population increase between 1995 and 2020 is about 85 percent for this foothill and mountain area, while the state’s growth is projected at less than 50 percent.

Per capita water use varies significantly throughout the area, from about 115 gallons per capita per day (gpcd) in the Volcano are of Amador County to about 420 gpcd in the southwestern corner of Lassen County.

Land Use

The economies of these mountain and foothill areas have historically been tied to the land. Tourism, ranching, timber harvesting, limited mining, and agriculture, primarily in the lower elevations, continue as an economic base for many communities. A limiting factor for the area’s population growth is the relatively small amount of land in private ownership. The federal government is the dominant landowner in the area, with most of the higher elevation lands being under the management of the U.S. Forest Service or National Park Service.

Much of the state's developed water supply originates in this upland area, including several CVP and SWP reservoirs. Although the region has abundant water supplies, the vast majority is unavailable locally due to prior appropriations for downstream or out-of-basin users. Local use of water originating in the region is less than 3 percent of the total statewide consumption.

Water Supply

The primary source of public consumptive water supply is locally developed surface water (almost 70 percent). Water is either diverted directly from the area’s streams and lakes or from local storage reservoirs and conveyance facilities. Many of the residents in the unincorporated areas are dependent on small, independent municipal water systems, or on untreated water diverted directly from one of the numerous raw water ditch delivery systems that run throughout the region. In addition, many individual water users throughout the area have developed their own supplies, typically groundwater for domestic use and surface or in limited cases, groundwater for agricultural use.

Regulation of Ditch Water – Water users in the foothills who obtain their water from ditches are no longer able to use that water for domestic purposes. New rules promulgated by the California Department of Health Services and the U.S. Environmental Protection Agency prohibit residential customers from cooking, drinking or brushing teeth with ditch water, including water processed by home treatment systems. In order to meet these requirements, several water districts are requiring customers to receive 5 gallons of bottled drinking water per month. This quantity meets the state's minimum estimate of what a normal household would use in a month.

Mining operations (especially hydraulic mining) of the gold rush era started much of the water supply development to the foothill and mountain areas. Many of those early mining water systems were later taken over by other water users. Pacific Gas & Electric Company and other hydropower utilities subsequently developed an extensive hydroelectric power and consumptive water use delivery system throughout the Sierra Nevada, often incorporating some of the old mining ditches. Most of these conveyance facilities devoted to consumptive water delivery were later transferred to local public entities. Many of these local water agencies still use the ditch systems as a primary means of water delivery to both their water treatment plants and to the individual water users located along the route to the treatment facilities. Many of these old and unimproved conveyance systems, including ditches, flumes, and pipes have been in use for more than 100 years.

While logging and mining operations have decreased, recreation and tourism have increased with consequent effects on water use and quality. Many of the foothill and mountain areas possess significant numbers of second homes and vacation rentals. This means that, although there is no permanent population associated with these homes, water use can be high on most weekends during the popular summer and winter vacation periods. For example, Groveland Community Services District, near Yosemite National Park in southern Tuolumne County, estimates that the service area population more than doubles during peak vacation periods. Tourism use, which is most significant in the central Sierra, tends to inflate the area’s per capita water use.

The majority of the area's irrigated acres are found in the foothills and mountains of the Sacramento River Region. The dominant crop is pasture, with about 70 percent of the irrigated acreage. Other crops with significant acreage include alfalfa, grain, wine grapes, apples and other deciduous fruit, and olives. Projections indicate almost no change in irrigated acreage through 2020, with a slight change in crop mix. Significant unirrigated areas are used for rangeland for livestock.

Environmental water use in the area is limited to instream flow requirements and one managed wetlands. Instream flow requirements within the area are found on the Stanislaus River, below Goodwin Dam, and the Tuolumne River, below La Grange Dam. The controlling instream requirements for the remainder of the area's many streams are located on the valley floors. In addition, many of the smaller reservoirs in the area do have instream, flow requirements, which are met by the project operators. However, only the largest instream requirement for a given stream is accounted as a demand and those requirements are more often found downstream of this foothill and mountainous area. Most environmental water flows originating from within the area result from meeting required environmental flows outside the area on the valley floors to the west. The Ash Creek Wildlife Area, a managed wetland, is located in the region.. The managed portion of the area includes 600 acres of permanent emergent wetlands, 700 acres of seasonally flooded lands, 1,000 acres of irrigated forage crop, and 3,600 acres of wet meadow. Water supplies include diversions from Ash Creek, Roberts Reservoir, and groundwater. The annual water use by the wildlife area is 13,000 acre-feet.

Groundwater constitutes about 16 percent of area-wide water supply and is generally a supply for single family homes. Groundwater availability is generally limited to fractured rock and small alluvial deposits immediately adjacent to the area's many streams. Many individuals in the area are wholly dependent upon groundwater for domestic use. A limited number of farmers have developed wells with enough production to irrigate their lands in all but the driest of years. In addition, many homes are not connected to a municipal water system and are typically dependent upon domestic wells or raw untreated water delivered through an open ditch system. In general, groundwater is inadequate and unreliable due to the limitations of the fractured granite to perform as a groundwater basin.

Other sources of supply, present in the area to a limited degree include Central Valley Project with other federal project water, locally developed imports, and reclaimed wastewater. El Dorado Irrigation District and Foresthill Public Utility District possess water supply contracts for CVP supply. Calaveras County Water District and Union Public Utility District receive water from New Hogan Reservoir, which is operated by the US Army Corps of Engineers. Irrigated pasture in Sierra County receives water imported from the Little Truckee River in the North Lahontan Region. In addition, PG&E exports water from Echo Lake near Lake Tahoe in the North Lahontan Region as part of a hydropower diversion to the American River basin. Reclaimed wastewater is used to a limited extent to irrigate golf courses and meet other landscaping and agricultural needs.

The following water balance table summarizes the detailed regional water accounting contained in the water portfolio at the end of this regional description. As shown in the table, most of the area's water flows to other hydrologic regions.

State of the Region

Challenges

By virtue of their location, domestic water users in the Mountain Counties generally benefit from higher quality water than most other Californians. Many water supplies are from pristine foothill or mountain sources, which are largely unaffected by agricultural or urban pollution. Unfortunately, all too often, this higher quality water is often degraded while in transit through the numerous open ditch delivery systems. Drainage from abandoned mines contributes metals and other water quality problems to downstream water bodies. Mercury was often brought into the region as part of the gold mining process. Erosion from natural flooding, logging and land development, and areas devastated from forest fires, causes sedimentation, and elevated temperatures due to the loss of riparian shade canopy. This is a concern to both domestic water treatment operations and migration and spawning of salmonids in areas not already blocked by water impoundments.

The biggest water issue facing users in the area is the need to improve the water supply reliability of the various systems throughout the area. Despite rapid population growth, the customer base of water systems is still relatively small. This smaller base, coupled with previous development of the less costly reservoir sites, as well as the topography, makes system improvements expensive and makes interconnections between systems impractical. Also, a limited array of options is available to meet current and projected needs due to the local water users' limited ability to pay and the impossibility of employing groundwater banking and conjunctive use strategies. Many local officials directly responsible for water delivery within the Mountain Counties Area anticipate a reliance on state "Area of Origin and Watershed Protection" law for both meeting projected growth within their respective areas as well as improving water supply reliability to existing users. These statutes provide for the reservation of water supplies for counties in which the water originates when a state water right filing is assigned for use elsewhere, as well as setting aside water for future development in the area (see Chapter 2 for more information). Typically, however, the upland areas have not had the population and capital base to contract with SWP or CVP, nor has the SWP or CVP had adequate supplies of unallocated water to meet the needs of upstream communities. A complicating factor is, in cases where Project water may be available, the potential service areas in the foothills are both higher in elevation and geographically distant from Project facilities, thus curtailing construction of expensive distribution systems.

Many small water systems in the foothills and mountains of California have historically tapped surface water or springs that required minimal treatment in order to meet both state and federal standards; other small systems rely upon delivery from open ditches. These systems, must maintain reliable filtration and disinfection facilities. When such treatment upgrades are infeasible, EPA and state health regulations are instead requiring customers to receive bottled drinking water. Common to the ditch delivery systems within the Mountain Counties region is the tendency to have large conveyance losses. Repairs on some systems have been opposed by various groups and landowners who argue the loss of the aesthetics of the flowing canal, loss of vegetation and wildlife created by leakage and percolation and who see the water saved as growth inducing.

After the 1997 floods, a landslide destroyed a 30-foot section of Georgetown's canal, which supplies water to 9,000 customers in six towns in rural El Dorado County. Nearby, El Dorado Irrigation District also lost use of it flume from the forebay on the American River due to a separate landslide.

The Mountain Counties areas are concerned with forest fires and the damage they cause to the watersheds and the wooden infrastructure associated with the ditch systems. Every year, numerous forest fires occur in the Sierra Nevada and expose the watershed to erosion and change runoff timing. Sediment can, obstruct water flow in open ditches, reduce reservoir capacity, add nutrient loading, diminish water quality and cause excessive algae growth. Fires have damaged components to the ditch systems including diversion structures and flume sections. As a result communities have been left without water for extended periods of time.

Water supply managers in the area are concerned about Federal and State designation of Wild and Scenic streams. Wild and Scenic status precludes water resources development. Environmental interests are concerned about preserving the few undeveloped streams or sections of streams remaining in the area. Federal statutes prohibit federal agencies from constructing, authorizing, or funding water resources projects having a direct and adverse effect on the values for which the river was designated. The state wild and scenic law prohibits construction of any dam, reservoir, diversion, or other water impoundment in specific regions. Diversions needed to supply domestic water to residents of counties through which the river flows may, in some cases, be authorized.

Like surface water, groundwater in this region is generally of good quality, but it may be contaminated by naturally occurring radon, uranium, and sulfide mineral deposits containing heavy metals. In particular, radon contamination is associated with granite, such as the granite batholith of the Sierra Nevada. Meeting state secondary standards for both iron and magnesium can also be difficult. Also, because of the lack of community wastewater systems, individual septic tanks are prevalent in this region, potentially adversely affecting groundwater quality.

In 1996, the University of California released its "Sierra Nevada Ecosystem Study," as apart of a project by the same name. The report is the result of a three year congressionally mandated study of the entire Sierra Nevada, with a primary emphasis on gathering and analyzing data to assist Congress and other decision makers in future management of the mountain range. The project goal is to maintain the health and sustainability of the ecosystem while providing resources to meet human needs. The study states that, "excluding the hard-to-quantify public good value of flood control and reservoir-based recreation, the hydroelectric generating, irrigation and urban use values of water are far greater than the combined value of all other commodities produced in the Sierra Nevada." The report estimates the value of water at 60 percent of all commodities produced in the foothills and mountains of the Sierra Nevada. This commodity-based view of water leads to some of the study's related conclusions that, "increased concern about the ecological impacts of diversions as well as the social decisions about who should bear the financial burdens of plans to reduce, or at least stop the growth of, these impacts requires a greater understanding of how diversions, economic benefits, and ecological impacts are linked."

Accomplishments

In 1997, Sacramento area interest released the Draft Recommendations for the water Forum Agreement. This stakeholder group is pursuing two objectives: (1) provide a reliable water supply for the region through 2030 and (2) reserve the fishery, wildlife recreation, and aesthetic values of the Lower American River. The proposed draft solution includes an integrated package of seven actions. Generally, foothill water interests would increase their diversions from the American River in average and wet years and decrease those diversions in drier and driest years. Placer County Water Agency would be providing excess water from non-American River sources to many of the participating water agencies during drier and driest years to help make up the decreased American River diversions in those years. PCWA's participation in many of these specific agreements is dependent upon State Water Resources Control Board approval for changes to conditions of its existing water rights.

Relationship to Other Regions

Much of the State's developed water supply originates in this upland area, including several CVP and SWP reservoirs and the local facilities of Yuba county Water Agency, East Bay Municipal Utility District, the city of San Francisco, Modesto and Turlock Irrigation Districts, and Merced Irrigation District.

Looking to the Future

The Mountain Counties Area has limited water supply options compared with many of the other hydrologic regions because of its topography, geology, small population, ability to pay, and the fact that most water originating in the area is used in downstream areas. However, most water agencies are actively pursuing a wide variety of supply augmentation and demand reduction actions to secure water needed in the future. For example, El Dorado Irrigation District is investigating construction of the 31,000 acre-feet Alder Reservoir to provide drought storage, enhanced environmental flows, and hydropower generation benefits. In addition to its ongoing water conservation and water recycling programs, the District is planning on lining a 2.5-mile ditch system to save an estimated 1,300 acre-feet per year.

Regional Planning

The Mountain Counties Water Resources Association assists water agencies and local governments in coordinating water resource matters important to the region. The Association also interfaces with applicable state officials and departments on water resource matters.
Some agencies are looking for new supplies from expansion of existing storage, re-operation of existing hydroelectric storage, or construction of new storage. For example, Lyons Reservoir, located in the Tuolumne Utilities District (TUD), is a 5,800 acre-foot joint use facility, supplying both hydroelectric power and consumptive water storage. TUD is considering the expansion of Lyons Reservoir to 50,000 acre-feet. While large quantities of groundwater are not generally available in the Sierra-Cascade Mountain Area, a number of local agencies are implementing groundwater management strategies to help ensure the reliability of local groundwater supplies.

Several local agencies and governments are developing recycled water projects. A few examples are:

- El Dorado Irrigation District is investigating construction of up to 5,000 acre-feet of seasonal storage to more efficiently use recycled water in the District. The storage would allow for meeting recycled water demands, without supplemental water or shortages through 2025.
- The city of Auburn is developing a proposal to sell up to 5,000 acre-feet of recycled water to agricultural users by 2020. (The water is expected to be delivered near Lincoln, on the valley floor. This option is included in the Sacramento River Region management plan.)
- The city of Angels Camp, in Calaveras County, is developing plans to expand its reclaimed water deliveries by 300 acre-feet to agricultural, environmental, and landscape users by 2020.
- Two other projects in Calaveras County will deliver 470 acre-feet for landscape irrigation.
- Groveland Community Services District, in southern Tuolumne County anticipates 425 acre-feet being made available to agricultural customers by 2020.

- The Sierra Conservation Center, in Tuolumne County, is planning a project to deliver almost 300 acre-feet for agriculture and landscape irrigation by 2020.

Urban growth, an average of 1800 new home each year, in the city of Lincoln has created a need for new drinking water in an area that has been served agricultural water since 1926. An association comprised of the Nevada Irrigation District, Placer County Water Agency, and the city of Lincoln is investigating how to accommodate this change in water use to eliminate the need to find additional water supplies or continue groundwater pumping to meet the domestic water needs.

In February 2000, South Sutter Water District, Camp Far West Irrigation District, and the California Department of Water Resources entered an agreement to meet the State Water Resource Control Boards water quality objectives (Phase 8 of the Water Quality Control Plan for the San Francisco/Sacramento-San Joaquin Delta Estuary). In exchange for up to 4,400 acre-feet of water from Camp Far West Reservoir in each dry and critical year, DWR agreed to assume all responsibility for all Bear River water rights holders' obligations under Phase 8. In addition, South Sutter Water District is implementing its Conveyance Canal Improvement Plan to increase the system conveyance capacity. The additional water for conveyance will be obtained from increases in diversion of stored water and water that is spilled from Camp Far West Reservoir.

SSWD's Conveyance Canal Improvement Plan

- Increase the flexibility, timing, and reliability of surface water supplies.
- Replenish groundwater supplies for extraction in drier years.
- Recharge the groundwater basin to reduce the effect of declining groundwater levels.
- Provide the ability to meet additional water needs (including Bay Delta Authority environmental objectives) outside of SSWD.
- Replace older conveyance structures with advanced control technology.
- Enhance SSWD's conjunctive water management activities.
- Reduce the need for cropping changes during drier water years.
- Increase power generation and decrease power use for pumping.
- Increase water use efficiency by installing state-of-the-art water control and measurement structures.

Water Portfolios for Water Years 1998, 2000, and 2001

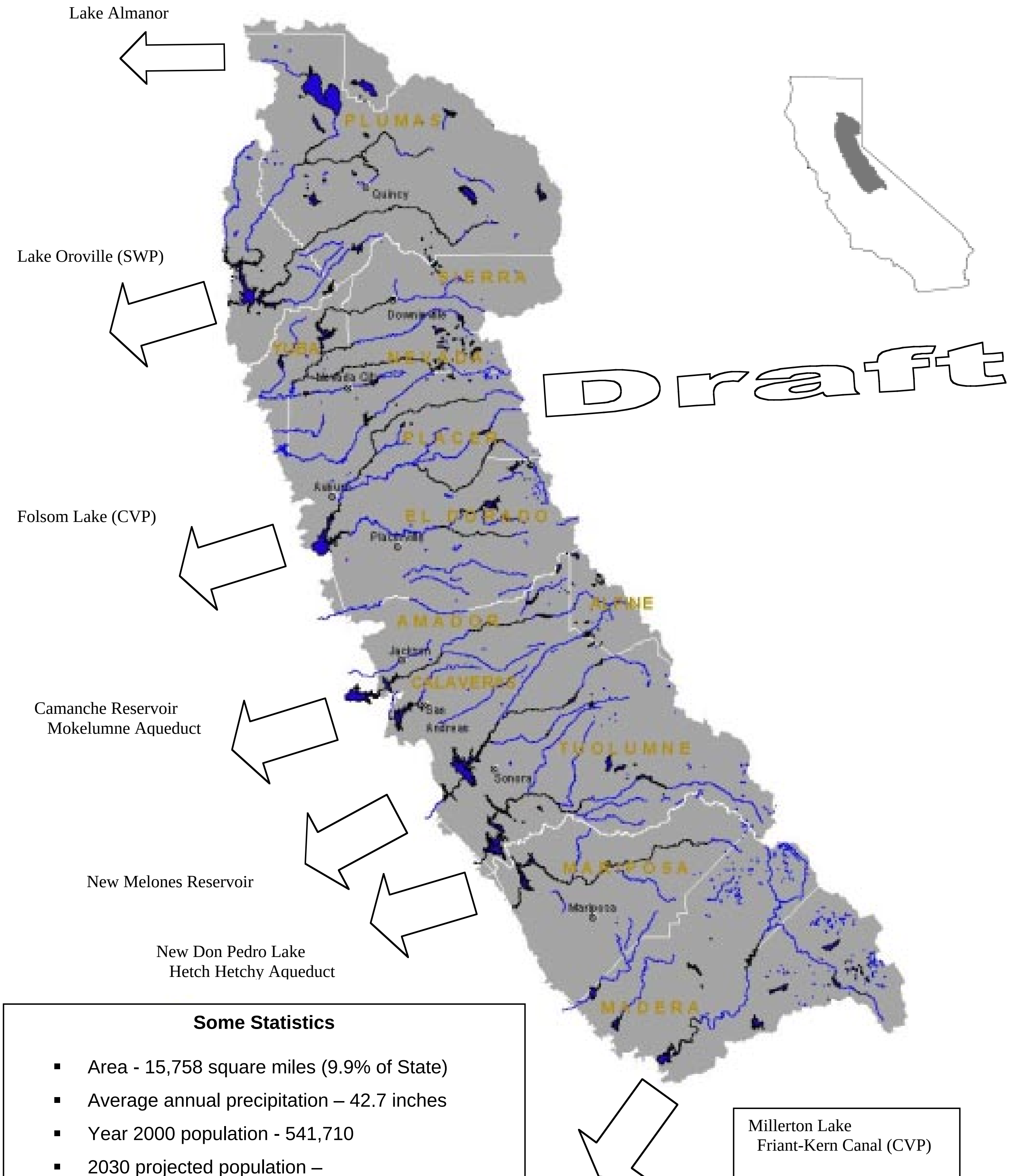
The following tables present actual information about the water supplies and uses for the Mountain Counties hydrologic region. Water year 1998 was a wet year for this region, with annual precipitation at 130 percent of normal, while the statewide annual precipitation was 170 percent of average. Year 2000 represents nearly normal hydrologic conditions with annual precipitation at 90 percent of average for the Mountain Counties region, and year 2001 reflected dryer water year conditions with annual precipitation at 55 percent of average. For comparison, statewide average precipitation in year 2001 was 75 percent of normal. Table 13-1 provides more detailed information about the total water supplies available to this region for these three specific years from precipitation, imports and groundwater, and also summarizes the uses of all of the water supplies. The three Water portfolio tables included in Table 13-2 and companion Water Portfolio flow diagrams (Figures 13-2, 13-3 and 13-4) provided more detailed information about how the available water supplies are distributed and used throughout this region.

A more detailed tabulation of the portion of the total available water that is dedicated to urban, agricultural and environmental purposes is presented in Table 13-3. Table 13-3 also provides detailed information about the sources of the developed water supplies, which are primarily from surface water systems and include a large percentage of water imports from other regions.

Sources of Information

- Water Quality Control Plan, Regional Water Quality Control Board
- Watershed Management Initiative Chapter, Regional Water Quality Control Board
- 2002 California 305(b) Report on Water Quality, State Water Resources Control Board
- Bulletin 118 (Draft), California's Groundwater, Update 2003, Department of Water Resources
- Nonpoint Source Program Strategy and Implementation Plan, 1998-2013, State Water Resources Control Board, California Coastal Commission, January 2000
- Strategic Plan, State Water Resources Control Board, Regional Water Quality Control Boards, November 15, 2001

Figure 13-1
Mountain Counties of California



Some Statistics

- Area - 15,758 square miles (9.9% of State)
- Average annual precipitation – 42.7 inches
- Year 2000 population - 541,710
- 2030 projected population –
- Total reservoir storage capacity - 18,185 TAF
- 2000 irrigated agriculture - 93,700 acres

Table 13-1
Mountain Counties of California Water Balance Summary – TAF

Water Entering the Region – Water Leaving the Region = Storage Changes in Region

	1998 (wet)	2000 (average)	2001 (dry)
Water Entering the Region			
Precipitation	55,206	38,412	23,445
Inflow from Oregon/Mexico	0	0	0
Inflow from Colorado River	0	0	0
Imports from Other Regions	0	0	0
Total	**55,206**	**38,412**	**23,445**
Water Leaving the Region			
Consumptive Use of Applied Water * (Ag, M&I, Wetlands)	236	303	263
Outflow to Oregon/Nevada/Mexico	0	0	0
Exports to Other Regions	4,374	3,744	2,606
Statutory Required Outflow to Salt Sink	3,404	2,331	1,636
Additional Outflow to Salt Sink	80	149	178
Evaporation, Evapotranspiration of Native Vegetation, Groundwater Subsurface Outflows, Natural and Incidental Runoff, Ag Effective Precipitation & Other Outflows	44,705	32,702	21,561
Total	**52,799**	**39,229**	**26,244**
Storage Changes in the Region [+] Water added to storage [–] Water removed from storage			
Change in Surface Reservoir Storage	2,420	-802	-2,721
Change in Groundwater Storage **	-13	-15	-78
Total	**2,407**	**-817**	**-2,799**

Applied Water * (compare with Consumptive Use) * Definition - Consumptive use is the amount of applied water used and no longer available as a source of supply. Applied water is greater than consumptive use because it includes consumptive use, reuse, and outflows.	397	464	447

**Footnote for change in Groundwater Storage

Change in Groundwater Storage is based upon best available information. Basins in the north part of the State (North Coast, San Francisco, Sacramento River and North Lahontan Regions and parts of Central Coast and San Joaquin River Regions) have been modeled – spring 1997 to spring 1998 for the 1998 water year and spring 1999 to spring 2000 for the 2000 water year. All other regions and year 2001 were calculated using the following equation:

GW change in storage =
intentional recharge + deep percolation of applied water + conveyance deep percolation – withdrawals

This equation does not include the unknown factors such as natural recharge and subsurface inflow and outflow.

Table 13-2
Water Portfolios for Water Years 1998, 2000 and 2001

Category	Description	Mountain Counties 1998 (TAF)				Mountain Counties 2000 (TAF)				Mountain Counties 2001 (TAF)				
Inputs:		Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Water Portfolio	Applied Water	Net Water	Depletion	Data Detail
1	Colorado River Deliveries		-				-				-			PSA/DAU
2	Total Desalination		-				-				-			PSA/DAU
3	Water from Refineries		-				-				-			PSA/DAU
4a	Inflow From Oregon		-				-				-			PSA/DAU
b	Inflow From Mexico		-				-				-			PSA/DAU
5	Precipitation	55,205.7				38,412.2				23,444.5				REGION
6a	Runoff - Natural	N/A				N/A				N/A				REGION
b	Runoff - Incidental	N/A				N/A				N/A				REGION
7	Total Groundwater Natural Recharge	N/A				N/A				N/A				REGION
8	Groundwater Subsurface Inflow	N/A				N/A				N/A				REGION
9	Local Deliveries		1,954.0				1,516.4				1,062.9			PSA/DAU
10	Local Imports		9.7				10.9				8.5			PSA/DAU
11a	Central Valley Project :: Base Deliveries		5.5				6.1				7.0			PSA/DAU
b	Central Valley Project :: Project Deliveries		20.2				20.2				11.4			PSA/DAU
12	Other Federal Deliveries		1.6				1.6				1.6			PSA/DAU
13	State Water Project Deliveries		-				-				-			PSA/DAU
14a	Water Transfers - Regional		-				-				-			PSA/DAU
b	Water Transfers - Imported		-				-				-			PSA/DAU
15a	Releases for Delta Outflow - CVP		-				-				-			REGION
b	Releases for Delta Outflow - SWP		-				-				-			REGION
c	Instream Flow		1,569.5				1,563.0				1,450.6			REGION
16	Environmental Water Account Releases		-				-				-			PSA/DAU
17a	Conveyance Return Flows to Developed Supply - Urban		-				-				-			PSA/DAU
b	Conveyance Return Flows to Developed Supply - Ag		23.0				-				-			PSA/DAU
c	Conveyance Return Flows to Developed Supply - Managed Wetla		-				-				-			PSA/DAU
18a	Conveyance Seepage - Urban		-				-				-			PSA/DAU
b	Conveyance Seepage - Ag		3.6				4.7				3.7			PSA/DAU
c	Conveyance Seepage - Managed Wetlands		-				-				-			PSA/DAU
19a	Recycled Water - Agriculture		1.2				1.2				1.2			PSA/DAU
b	Recycled Water - Urban		-				-				-			PSA/DAU
c	Recycled Water - Groundwater		-				-				-			PSA/DAU
20a	Return Flow to Developed Supply - Ag		56.0				-				-			PSA/DAU
b	Return Flow to Developed Supply - Wetlands		-				-				-			PSA/DAU
c	Return Flow to Developed Supply - Urban		-				-				-			PSA/DAU
21a	Deep Percolation of Applied Water - Ag		6.0				6.1				4.5			PSA/DAU
b	Deep Percolation of Applied Water - Wetlands		-				-				-			PSA/DAU
c	Deep Percolation of Applied Water - Urban		19.2				17.6				18.3			PSA/DAU
22a	Reuse of Return Flows within Region - Ag		7.7				12.0				6.9			PSA/DAU
b	Reuse of Return Flows within Region - Wetlands, Instream, W&S		4,917.6				3,330.3				1,783.0			PSA/DAU
24a	Return Flow for Delta Outflow - Ag		-				-				-			PSA/DAU
b	Return Flow for Delta Outflow - Wetlands, Instream, W&S		3,403.8				2,331.4				1,636.4			PSA/DAU
c	Return Flow for Delta Outflow - Urban Wastewater		-				-				-			PSA/DAU
25	Direct Diversions	N/A				N/A				N/A				PSA/DAU
26	Surface Water in Storage - Beg of Yr	11,595.4				12,504.6				11,702.6				PSA/DAU
27	Groundwater Extractions - Banked	-				-				-				PSA/DAU
28	Groundwater Extractions - Adjudicated	-				-				-				PSA/DAU
29	Groundwater Extractions - Unadjudicated	60.5				61.2				73.9				REGION
Withdrawals:	**In Thousand Acre-feet**													
23	Groundwater Subsurface Outflow	-				-				-				REGION
30	Surface Water Storage - End of Yr	14,015.1				11,702.6				8,982.1				PSA/DAU
31	Groundwater Recharge-Contract Banking		-				-				-			PSA/DAU
32	Groundwater Recharge-Adjudicated Basins		-				-				-			PSA/DAU
33	Groundwater Recharge-Unadjudicated Basins		-				-				-			REGION
34a	Evaporation and Evapotranspiration from Native Vegetation				N/A				N/A				N/A	REGION
b	Evaporation and Evapotranspiration from Unirrigated Ag				N/A				N/A				N/A	REGION
35a	Evaporation from Lakes				92.4				107.2				98.5	REGION
b	Evaporation from Reservoirs				630.2				711.0				646.4	REGION
36	Ag Effective Precipitation on Irrigated Lands		75.2				51.9				70.8			REGION
37	Agricultural Use		261.3	247.6	191.5		329.7	311.6	311.6		305.9	294.5	294.6	PSA/DAU
38	Wetlands Use		-	-	-		-	-	-		-	-	-	PSA/DAU
39a	Urban Residential Use - Single Family - Interior		29.4				28.9				30.0			PSA/DAU
b	Urban Residential Use - Single Family - Exterior		60.4				60.1				62.6			PSA/DAU
c	Urban Residential Use - Multi-family - Interior		10.2				10.1				10.5			PSA/DAU
d	Urban Residential Use - Multi-family - Exterior		3.3				3.6				3.8			PSA/DAU
40	Urban Commercial Use		10.8				10.5				11.2			PSA/DAU
41	Urban Industrial Use		10.3				10.3				10.4			PSA/DAU
42	Urban Large Landscape		11.3				11.0				11.6			PSA/DAU
43	Urban Energy Production		-				-				-			PSA/DAU
44	Instream Flow		1,569.5	1,269.9	1,269.9		1,563.0	1,305.8	1,305.8		1,450.6	1,323.1	1,323.1	PSA/DAU
45	Required Delta Outflow		-	-	-		-	-	-		-	-	-	PSA/DAU
46	Wild & Scenic Rivers Use		6,751.9	2,133.9	2,133.9		4,098.7	1,025.6	1,025.6		1,968.8	313.3	313.3	PSA/DAU
47a	Evapotranspiration of Applied Water - Ag				176.9				248.6				205.9	PSA/DAU
b	Evapotranspiration of Applied Water - Managed Wetlands				-				-				-	PSA/DAU
c	Evapotranspiration of Applied Water - Urban				59.3				54.5				56.7	PSA/DAU
48	Evaporation and Evapotranspiration from Urban Wastewater				-				-				-	REGION
49	Return Flows Evaporation and Evapotranspiration - Ag				6.0				7.8				6.0	PSA/DAU
50	Urban Waste Water Produced	43.4				50.7				52.7				REGION
51a	Conveyance Evaporation and Evapotranspiration - Urban				10.0				9.6				9.6	PSA/DAU
b	Conveyance Evaporation and Evapotranspiration - Ag				10.7				23.9				22.7	PSA/DAU
c	Conveyance Evaporation and Evapotranspiration - Managed Wetlands				-				-				-	PSA/DAU
d	Conveyance Loss to Mexico				-				-				-	PSA/DAU
52a	Return Flows to Salt Sink - Ag				12.4				77.6				104.2	PSA/DAU
b	Return Flows to Salt Sink - Urban				67.2				71.6				74.2	PSA/DAU
c	Return Flows to Salt Sink - Wetlands				-				-				-	PSA/DAU
53	Remaining Natural Runoff - Flows to Salt Sink				0.0				0.0				0.0	REGION
54a	Outflow to Nevada				-				-				-	REGION
b	Outflow to Oregon				-				-				-	REGION
c	Outflow to Mexico				-				-				-	REGION
55	Regional Imports	0.0				0.0				0.0				REGION
56	Regional Exports	4,373.6				3,744.1				2,605.6				REGION
59	Groundwater Net Change in Storage	-12.5				-15.1				-78.2				REGION
60	Surface Water Net Change in Storage	2,419.7				-802.0				-2,720.5				REGION
61	Surface Water Total Available Storage	18,185.0				18,185.0				18,185.0				REGION

Colored spaces are where data belongs. N/A - Data Not Available "-" - Data Not Applicable "0" - Null value

Table 13-3
Mountain Counties of California Water Use and Distribution of Dedicated Supplied

	1998			2000			2001		
	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion	Applied Water Use	Net Water Use	Depletion
WATER USE									
Urban									
Large Landscape	11.3			11.0			11.6		
Commercial	10.8			10.5			11.2		
Industrial	10.3			10.3			10.4		
Energy Production	0.0			0.0			0.0		
Residential - Interior	39.6			39.0			40.5		
Residential - Exterior	63.7			63.7			66.4		
Evapotranspiration of Applied Water		59.3	59.3		54.5	54.5		56.7	56.7
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		57.3	57.3		62.4	62.4		65.0	65.0
Conveyance Losses - Applied Water	19.9			18.8			18.8		
Conveyance Losses - Evaporation		10.0	10.0		9.6	9.6		9.6	9.6
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		9.9	9.9		9.2	9.2		9.2	9.2
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Urban Use	**155.6**	**136.5**	**136.5**	**153.3**	**135.7**	**135.7**	**158.9**	**140.5**	**140.5**
Agriculture									
On-Farm Applied Water	261.3			329.7			305.9		
Evapotranspiration of Applied Water		176.9	176.9		248.6	248.6		205.9	205.9
Irrecoverable Losses		6.0	6.0		7.8	7.8		6.0	6.0
Outflow		64.6	8.6		55.2	55.2		82.7	82.7
Conveyance Losses - Applied Water	49.7			61.8			58.1		
Conveyance Losses - Evaporation		10.7	10.7		23.9	23.9		22.7	22.7
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		26.8	3.8		22.4	22.4		21.5	21.5
GW Recharge Applied Water	0.0			0.0			0.0		
GW Recharge Evap + Evapotranspiration		0.0	0.0		0.0	0.0		0.0	0.0
Total Agricultural Use	**310.9**	**285.0**	**206.0**	**391.5**	**357.9**	**357.9**	**364.0**	**338.8**	**338.8**
Environmental									
Instream									
Applied Water	1,569.5			1,563.0			1,450.6		
Outflow		1,269.9	1,269.9		1,305.8	1,305.8		1,323.1	1,323.1
Wild & Scenic									
Applied Water	6,751.9			4,098.7			1,968.8		
Outflow		2,133.9	2,133.9		1,025.6	1,025.6		313.3	313.3
Required Delta Outflow									
Applied Water	0.0			0.0			0.0		
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Managed Wetlands									
Habitat Applied Water	0.0			0.0			0.0		
Evapotranspiration of Applied Water		0.0	0.0		0.0	0.0		0.0	0.0
Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Applied Water	0.0			0.0			0.0		
Conveyance Losses - Evaporation		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Irrecoverable Losses		0.0	0.0		0.0	0.0		0.0	0.0
Conveyance Losses - Outflow		0.0	0.0		0.0	0.0		0.0	0.0
Total Managed Wetlands Use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Environmental Use	**8,321.4**	**3,403.8**	**3,403.8**	**5,661.7**	**2,331.4**	**2,331.4**	**3,419.4**	**1,636.4**	**1,636.4**
TOTAL USE AND LOSSES	**8,788.0**	**3,825.3**	**3,746.3**	**6,206.5**	**2,825.0**	**2,825.0**	**3,942.3**	**2,115.7**	**2,115.7**
DEDICATED WATER SUPPLIES									
Surface Water									
Local Deliveries	1,954.0	1,954.0	1,876.5	1,516.4	1,516.4	1,516.4	1,062.9	1,062.9	1,062.9
Local Imported Deliveries	9.7	9.7	9.3	10.9	10.9	10.9	8.5	8.5	8.5
Colorado River Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CVP Base and Project Deliveries	25.7	25.7	24.7	26.3	26.3	26.3	18.4	18.4	18.4
Other Federal Deliveries	1.6	1.6	1.5	1.6	1.6	1.6	1.6	1.6	1.6
SWP Deliveries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Required Environmental Instream Flow	1,806.4	1,806.4	1,806.4	1,241.9	1,241.9	1,241.9	982.2	982.2	982.2
Groundwater									
Net Withdrawal	26.7	26.7	26.7	26.7	26.7	26.7	40.9	40.9	40.9
Artificial Recharge	0.0			0.0			0.0		
Deep Percolation	33.8			34.5			33.0		
Reuse/Recycle									
Reuse Surface Water	4,928.9			3,347.0			1,793.6		
Recycled Water	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
TOTAL SUPPLIES	**8,788.0**	**3,825.3**	**3,746.3**	**6,206.5**	**2,825.0**	**2,825.0**	**3,942.3**	**2,115.7**	**2,115.7**
Balance = Use - Supplies	*-0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Figure 13-2
Mountain Counties of California 1998 Flow Diagram
In Thousand Acre-Feet (TAF)

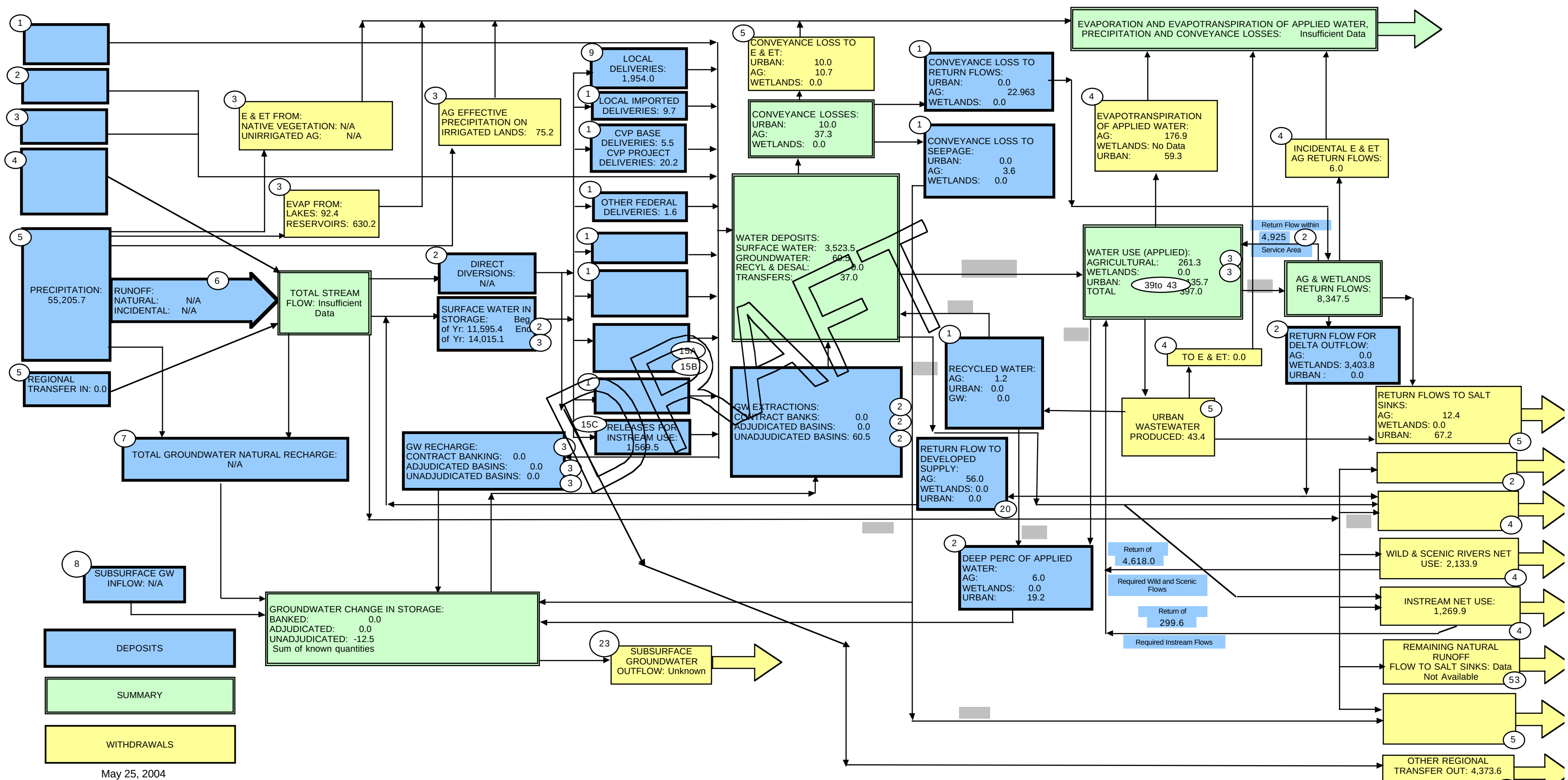


Figure 13-3
Mountain Counties of California 2000 Flow Diagram
In Thousand Acre-Feet (TAF)

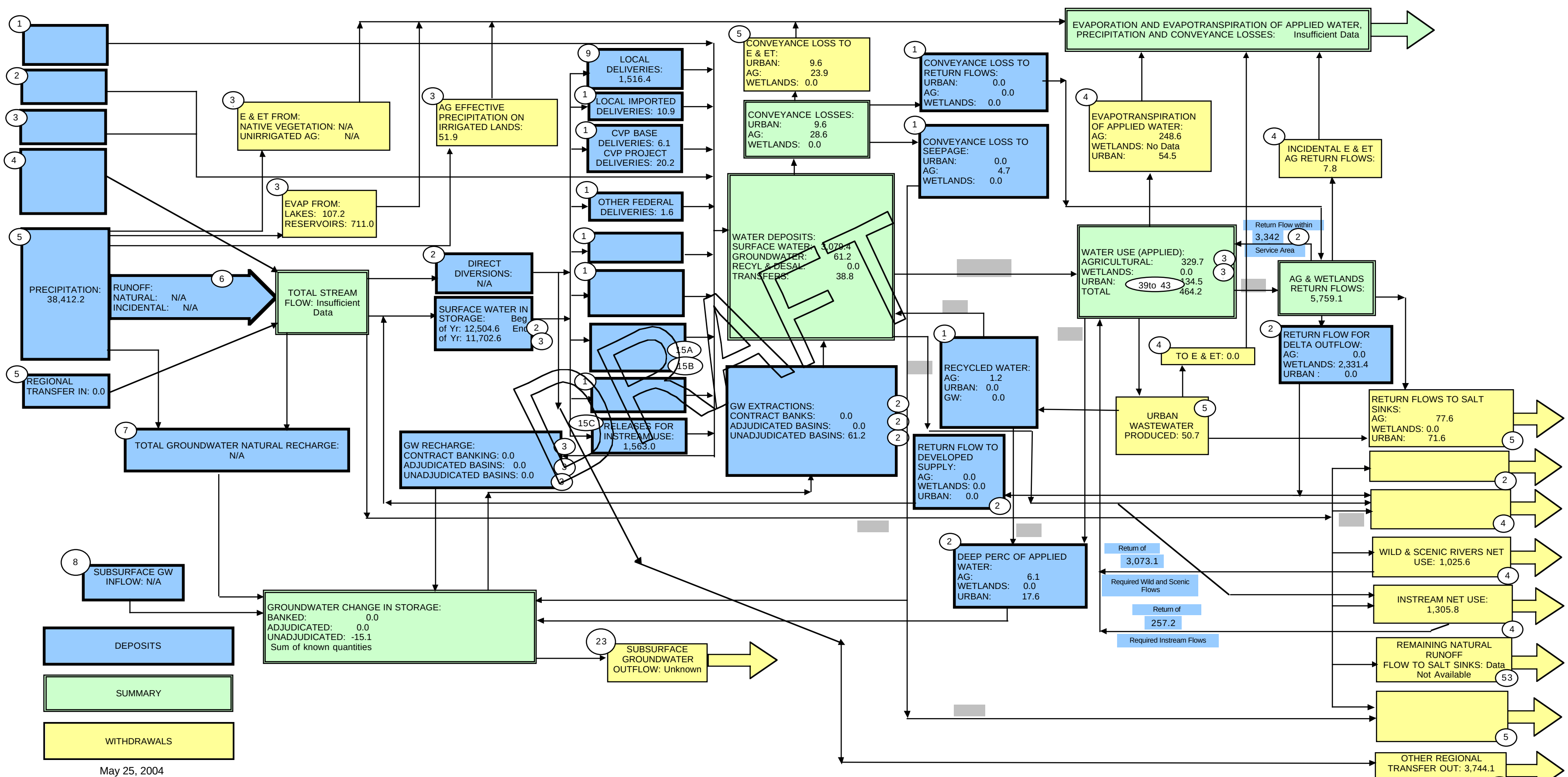


Figure 13-4
Mountain Counties of California 2001 Flow Diagram
In Thousand Acre-Feet (TAF)